

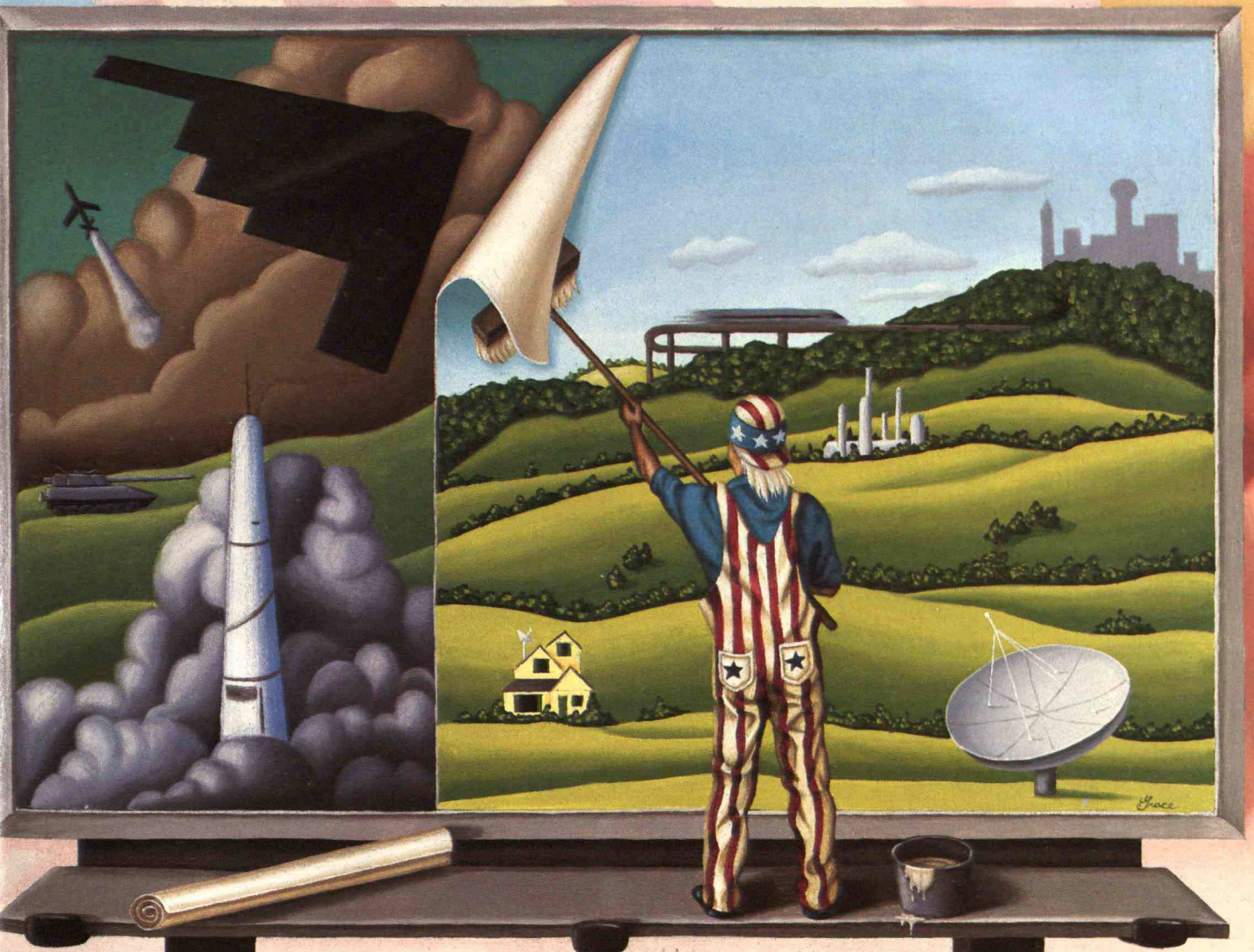
Technology Review

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Redirecting R&D for a Post Cold War Economy



ALSO IN THIS ISSUE:

- ★ COMPUTER ECSTASY ★
- ★ THINKING GLOBALLY, ACTING REGIONALLY ★
- ★ UNDERSTANDING ANIMAL RIGHTS ★
- ★ GREEN ENTREPRENEURS ★

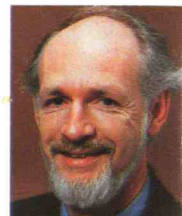
technology review

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In 1917 Boeing built its first airplane, 20

If you are an engineer or scientist, we'd like you to consider Boeing as a place to pursue your career. That's what this advertisement is all about. It's based on the belief that a good way to learn about a company is to meet the people who work there. To that end, we'd like to introduce Dr. John McMasters, a research aerodynamicist and one of some 20,000 engineers at Boeing. In his workaday world, he helps design Boeing jetliners. In his spare time, he's a self-proclaimed paleoaerodynamicist.



Ask Dr. John McMasters to define the proper field of study for an airplane designer and he'll say, "Everything that flies. All the time, professionally and avocationally."

That includes jetliners, certainly. And also insects, seeds, birds, bats, a certain reptile that executes aerial maneuvers of surprising grace and precision, hang gliders and boomerangs. Plus things that once flew, but don't now, such as pterosaurs.

Especially pterosaurs, in fact. They dominated flight for 120 million years and, reptiles or jets, all flying things encounter the same basic problems.

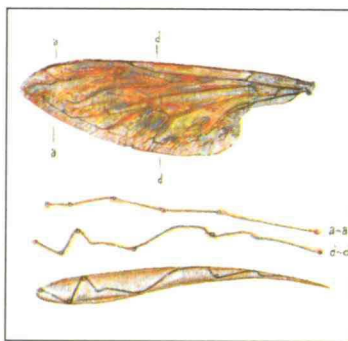
Sit back and ask McMasters to elaborate. It's a fascinating story.

You'll learn that 20 years ago, as a graduate student, he embarked on what he now describes as a ridiculously complex enterprise: the study of general locomotion.

"It was not the least bit modest," he says. "I envisioned a grand theory of optimal locomotion embracing the entire range of natural and man-made devices traveling through the air, on land, and in or on water."

His unified theory remains elusive, but the search has been hugely rewarding.

McMasters' investigations have included jumbo jets, bat wing architecture, the wing geometry of soaring birds, the

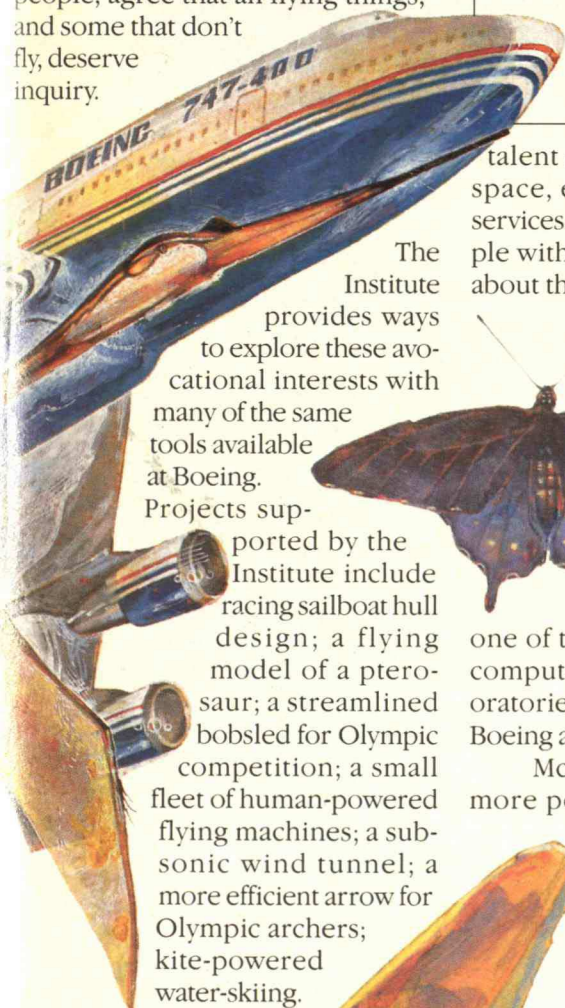


The irregular surface and tubular structure of insect wings are an elegant solution to a very difficult flight problem.

million years after reptiles learned to fly.

complexities of flapping flight, and similarities between hang gliders and flying reptiles.

Along the way, he helped found the Flight Research Institute (FRI). Members, including many Boeing people, agree that all flying things, and some that don't fly, deserve inquiry.



All very intriguing, you say, but so what? What difference does it make?

There are at least two answers.

McMasters points out that Boeing needs the best scientific and engineering



The pinion feathers at the wing tips of large land-soaring birds are a natural model for winglets on the newest Boeing 747 jetliner.

talent available in aviation, aerospace, electronics and computer services. The company looks for people with ideas and a lively curiosity about the world and its possibilities.

Boeing supports inventive minds in many ways, contributing to higher education, helping employees pursue advanced degrees, creating courses and institutes if necessary, including one of the world's most advanced computational fluid dynamics laboratories—one of the tools used by Boeing aerodynamicists.

McMasters' second answer is more personal: "What began as a naive but serious enterprise has become a sort of merry drunkard's walk through a range of fascinating topics.

"My inquiries continue, despite suggestions from some doubters that there's little commercial value in designing better butterflies, and thus no merit at all in understanding how they work. I believe understanding the principles of flight helps make one a better designer of devices that do

have commercial value.

"Equally important, I believe it's periodically valuable to stand back from the details of a career to see a whole picture—to see one's work in full perspective.

"The effort can be immensely refreshing. And humbling."



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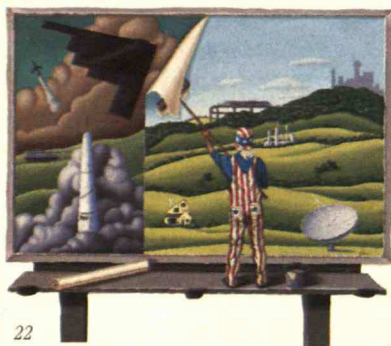
If you have questions about the opportunities for scientific and engineering professionals, include a note specifying your area of interest, and a knowledgeable Boeing engineering representative will respond. We are an equal opportunity employer.

Dr. McMasters is a research aerodynamicist at Boeing Commercial Airplanes Division. He has taught at Purdue University and Arizona State University and has written 65 technical papers, reports and articles. He is preparing a book on the Biological Origins of the Aeroplane. McMasters is a graduate of the University of Colorado and Purdue.

BOEING

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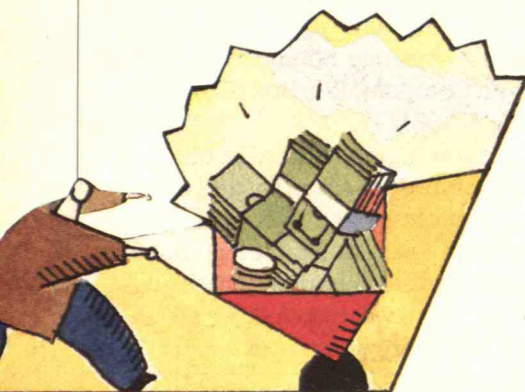
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Computers not only confer a sense of power and mastery; for many ordinary users, the machines provoke a state of ecstasy. But manufacturers and software engineers are still stressing productivity rather than the pleasure principle.

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The animal rights movement continues to reflect public skepticism about the value of scientific research. Resolving the standoff will require openness and a sharing of power by research institutions.



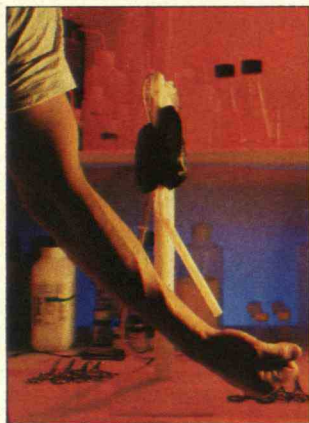
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First Line

Helping the Russians, Helping Ourselves

LOOKING beyond their present struggle just to survive, the people of the former Soviet Union hope to develop market-based economies on a par with those of the Western democracies. They clearly have a long way to go, and they'll need a great deal of help—the sooner, the better—if they are to stay on track.

Americans generally sympathize with the former Soviets and wish them well, but so far we've been more talk than action. With our own economy in the doldrums, major mobilizations of capital have seemed out of the question. Yet most experts agree that what people there need most is nonpecuniary "technical assistance"—the benefit of Western industrial and commercial experience, relayed in person and over extended periods by its practitioners—in running capitalist enterprises.

"Technical assistance should come without bells and whistles," says William Robinson, a Seattle-based attorney who represents American companies doing business in the former USSR. Help should consist of "such fundamental Western-style management skills as operating a plant," he says, and involve "line guys working in the trenches with each other."

But if such help is to ultimately prove useful, the helpers must stay awhile. "People typically come through, spend four hours on site, then get on a plane and fly away," says Cynthia Stone, director of Newgate Ventures, a venture capital firm in New York with projects in the former USSR. "We need to build a grid there of people who log extensive time on the ground" developing useful working relationships.

For their part, the former Soviets not only yearn for such sustained technical assistance from the West, they'd especially like it American-style. But as *Newsweek* recently noted, the United States "is frittering away its leverage

while Germany and others gain influence and access at America's expense." Things could easily be otherwise. "The Russians don't feel comfortable with these people," says Robert Watson, co-director of the Soviet Energy Project at the Natural Resources Defense Council. "They want American technology, and they want Americans working with them. Yet here we are sitting on our hands."

We in the United States have great incentive to get off our hands—or, perhaps more accurately in these recessionary times, off our duffs—because help-

*Let's invade
the former USSR
with capitalist workers
and managers to create
powerful partners and
new markets.*

ing the former Soviets is a great opportunity both to do the right humanitarian thing and to help ourselves. The technical expertise and management savvy they so desperately need is in excess supply here at home because of scaled-down business activity and straight-out unemployment.

Western government agencies, companies, trade associations, professional societies, unions, and foundations usually think in terms of helping sister institutions in the republics develop or change, but they could also get down to the real nitty-gritty by establishing programs that send skilled individuals there for extended stays. Programs with the practical put-'em-back-to-work philosophy of the old Work Projects Administration and Civilian Conservation Corps, which served the United States so well in its own Great Depression, combined with the idealistic spirit of the Peace Corps would offer intense and rewarding outlets for the skills and talents of a wide variety of Americans.

Although federal prompting of such activity is necessary, it is not sufficient. Direct government action is needed along two complementary tracks: to coordinate the diverse efforts of companies and other organizations; and to run a centerpiece national program that unambiguously represents U.S. policy—foreign, trade, industrial—and commitment.

One possible vehicle for the latter is the Peace Corps itself, which has already begun work in Eastern Europe. But its volunteer levels there are relatively modest, and most individuals pursue projects such as the teaching of English. The Peace Corps could greatly expand its scope to embrace a broader spectrum of technical and management skills, and fortify itself with resources both human and monetary—of private as well as public origin. Perhaps the plan to establish a Eurasian Foundation for Democracy, which Secretary of State James A. Baker announced at the end of January, is a modest start.

Graham Allison, professor of government at Harvard University, has bigger ideas. He proposes a vast program for the former Soviet Union—supported by all the Western nations—analogue to the Marshall Plan that helped European countries rebuild their economies after World War II. "This would provide confidence," he says, relaying to the former Soviets that "you won't fail from an absence of our efforts." And it would establish "strategic direction," especially if led by "people of great stature and authority," he adds.

Such initiatives could raise what used to be called "cultural exchange" during the depths of the Cold War to a vastly greater scale, enriching all parties in the process. It could stimulate entire nations, including our own, by helping to create economically powerful partners and whole new markets for the resulting products and services. And it would be a fine way for national leaders to address foreign policy and domestic issues simultaneously. ■

—STEVEN J. MARCUS

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Letters

CITIZENS AS POLICYMAKERS

Work my colleagues and I have done at Harvard University's Jefferson Physical Laboratory corroborates what John Doble and Amy Richardson say in "You Don't Have to Be a Rocket Scientist . . ." (*TR January 1992*). In a pilot experiment we initiated in 1980 with the Public Agenda Foundation, we found that flawed or uninformed ideas about scientific policy issues are not immune to relatively brief intervention.

Our study convened population-representative groups of nine to fourteen persons each, located in six different cities across the United States, to discuss for an evening questions of policy or ethics and make decisions about them. All the questions seemed to require significant scientific and technical understanding—for example, one concerned the separation of isotopes of fissionable material.

At the beginning, each of the several participating groups produced rather predictable top-of-the-head judgments that revealed the level of scientific and technological ignorance found in many polls. But after each group had debated the scientific and technical issues with the aid of explanatory materials furnished to them, it made a second decision, which turned out to be about the same as the results obtained separately from groups of professional scientists. Thus with some care and resources, one can hope to engage inexpert citizens in working through scientific problems that have social and political dimensions.

GERALD HOLTON

Mallinckrodt Professor of Physics and
Professor of History of Science
Harvard University

Doble and Richardson's research on public participation in policy decisions is irrelevant. Participants in the exercise were unbiased and randomly selected, but in actual issues such as waste disposal, landfill location, emission controls, and anything nuclear, public participants have a direct interest. In fact, to participate fully as interveners, parties must demonstrate that they will be personally affected by a given decision.



And who could argue with the conclusion that people can learn from well-prepared, colorful, concise presentations followed by a discussion? (Of course, one might ask who produced the "balanced" 20-minute videotape.) The authors' glowing report that the majority of the participants in the study came to agree with the scientists is also rather odd: if that is the result, why not just ask the scientists in the first place?

Finally, it's worth noting that agreement with scientists in general is hardly common for real public interest groups. In many cases, their position is represented only by a fringe scientist, and since it is driven not by science but by their agenda, it does not change.

A. DAVID ROSSIN

Visiting Scientist

University of California at Berkeley

The writer served as assistant secretary for nuclear energy in the U.S. Department of Energy from 1986 to 1987.

PEER REVIEW RECONSIDERED

"Peer Review: Treacherous Servant, Disastrous Master" by Charles W. McCutchen (*TR October 1991*) is interesting, but the way the author presents his case weakens it. He commits a classic gaffe by making abstruse, out-of-context statements that a nonspecialist audience cannot hope to evaluate. He also decries the "unpleasantness" in scientific debate, yet his comments about professional rivals have a distinctly snide tone. And as he himself admits, his remarks are heavily anecdotal. This is a particular problem when he is describing allegations of questionable conduct

that are still unresolved—especially those having to do with his own work. Readers are confronted with assertions they have no way of critically assessing.

All this notwithstanding, I'm basically in sympathy with Dr. McCutchen. Whereas humanistic scholarship is intrinsically conservative and has achieved its greatest glories when at its most preservationist—from passing on the classics in the Dark Ages to maintaining traditional cultural values in Eastern Europe during the Soviet occupation—science is revolutionary by nature and has known its finest hours when at its most disruptive—from Galileo to quantum mechanics.

I see no quick fixes for this dilemma. Maintaining multiple funding channels as Dr. McCutchen suggests seems prudent: peer selectors and agency selectors both play politics, but they're not the same politics, so diversity is promoted.

ERWIN S. STRAUSS
Fairfax, Va.

I can confirm that in my own field of orthopedics, the politics of reviewing are intense, just as McCutchen suggests. For example, the last grant proposal I sent to the NIH was reviewed by a committee that included people with backgrounds in mechanical engineering, endocrinology, biochemistry, and physiology. There were practicing orthopedic surgeons on the panel as well. But only four of the nineteen committee members might have had some detailed knowledge about the scientific aspects of my proposal. These four people control much of what happens in an orthopedic sub-field loosely called orthopedic biomechanics, and the political pressures on them must be substantial, since everyone knows who they are.

I also concur with Dr. McCutchen that time constraints can present major problems in reviewing. Meetings of review committees for grants can go on forever, and taking time to debate differences of opinion in a gathering of nine-teen overworked people, most of whom won't understand what is being debated, is not encouraged. What generally hap-

pens is that the primary and secondary reviewers of the grant under consideration air their opinions and the floor is opened to discussion. Clearly, a strongly positive or negative evaluation from one of those two reviewers will set the tone, and the discussion will be as short as possible. If there is enough dissent, I am told, a minority opinion is generated. However, given all the pressure everyone is under, I wonder how many minority opinions actually emerge from NIH committees.

Despite these difficulties, we should not forget how well the review system is really doing. Nor should we overlook the forces that hold political posturing in check. After all, politics has nothing to do with whether a device works. Perhaps you can get a fraudulent paper into press, and even get money to work on it, but if you ever start a company to produce something based on fraudulent data, you'll go broke. You can fool Daddy Warbucks, but not Mother Nature.

TIMOTHY P. HARRIGAN
Professor of Orthopedic Surgery
University of Missouri-Kansas City



FROM RED TO GREEN

"Managing Russia's Environment, Market-Style" by Steven J. Marcus (*TR* January 1992) provides a concise overview of the challenges facing Soviet environmentalists as the country moves from an authoritarian government to a market economy overseen by democratic institutions.

We at the Natural Resources Defense Council (NRDC) maintain several programs in the former Soviet Union, cover-
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MIT Reporter

GENETICISTS' NEW DARLING

 Construction workers at the Whitehead Institute for Biomedical Research are installing an incongruous piece of equipment this spring—a rooftop greenhouse. When it's finished in May, MIT biology professor Gerald Fink, the institute director, will fill it with row after row of his favorite plant—a spindly weed that tastes horrible, doesn't cure anything, and has no commercial value.

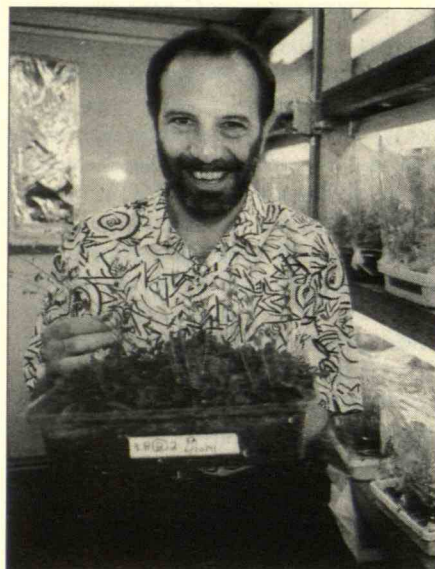
This is not a case of indulging the boss's quirky hobby. The greenhouse is a sign of the growing fascination with *Arabidopsis thaliana*, a plant that is fast becoming the new darling of the genetics research community. Nicknamed “the fruit fly of the plant world” because of its advantages as a genetic model, *Arabidopsis* has been embraced by hundreds of labs around the world in the last five years.

Fink, who has used his influence in the genetics community to promote *Arabidopsis*, says research on the plant will speed up efforts to improve crops and ornamental plants through genetic engineering; may lead to the discovery of new drugs; and could shed light on developmental processes in a wide range of organisms, perhaps even humans.

But Fink says that what really attracted him to *Arabidopsis* was a basic curiosity about the “unusual life forms” we call plants. They can't run away from predators, so evolution has provided them with powerful chemical means for warding off foragers. They can't run after mates, so they have coopted insects to act as marriage brokers. Plants “demonstrate a different way of dealing with what we consider the major problems of life,” Fink says.

Such matters have long been studied by plant biologists, but their genetic underpinnings have remained obscure. The reason: while studies on simple organisms like fruit flies and nematode worms have allowed geneticists to make great strides in understanding animals, there has been no comparable model system for studying plants.

Enter *Arabidopsis*. This nondescript



member of the mustard family is the perfect plant for the urban research lab. It stands less than a foot tall, has a life span of only six weeks, produces thousands of seeds, needs minimal care, and can be grown in a test tube. Even better, *Arabidopsis* has the smallest genome, or set of genes, of any known flowering plant. And its DNA is virtually free of the repeated chemical sequences that, in most other plants, make life tough on researchers trying to create mutant strains or locate genes of interest.

It was the discovery of these genetic features in the mid-1980s that triggered the explosion of interest in *Arabidopsis*. In strong support is the National Science Foundation, which pumped \$7.8 million into U.S. *Arabidopsis* research last year and helped set up a 10-year multinational research project on the plant and its genome.

A Big Find

Perhaps the most important findings have come from the floral development studies of Elliot Meyerowitz, a California Institute of Technology biologist. By studying *Arabidopsis* mutants with misplaced flower parts, Meyerowitz identified three genes that turn on early in development. The genes define four concentric regions of the flower and guide

Just as geneticists have made great strides in understanding animals by studying fruit flies, researchers (including MIT biologist Ethan Signer, left) hope to better understand flowering plants through the weed Arabidopsis thaliana.

the cells in each part to become the proper sexual organs.

Soon after Meyerowitz's discovery, other researchers found the same pattern in snapdragon, and Fink expects sexual development will prove similar in all flowering plants. “If you understand it in *Arabidopsis*, you understand it everywhere,” he says.

The agricultural applications of the research could be enormous, Meyerowitz notes, because almost all major crops are the products of flowers, namely fruits and seeds. “When we can manipulate the development of those flowers,” he says, “it will be a very powerful tool for feeding people.”

In theory, the fastest way to achieve such manipulation will be through genetic engineering. But while biologists have a number of techniques for introducing new genetic material into plants, the results are usually disappointing, says MIT biologist Ethan Signer. Instead of replacing an existing gene, a new gene often ends up at a random place in the plant's DNA, with no effect—or worse. And even if a gene inserts itself at the right spot, its effect might be muted or negated by another gene in the plant. By studying how DNA is repaired and shuffled in *Arabidopsis*, Signer hopes to find more reliable ways to replace existing plant genes with “new and improved” versions.

Meanwhile, work on *Arabidopsis* that could have important implications for human health is under way. At Harvard Medical School, geneticist Frederick Ausubel is studying how the plant responds to infections by bacteria called *Pseudomonas*, which also infect people. Some of his research involves trying to identify the specific genes that allow *Arabidopsis* to fight off the bacteria, thereby aiding the design of drugs targeted to that invader alone. This would be an

improvement on current antibiotics, most of which simply wipe out all bacteria, good as well as bad.

Fink, too, is studying the way plants respond to injury and infection. While they have no immune system, many plants defend themselves quite well by secreting noxious compounds—neurotoxins, heart stimulants, hallucinogens—to fend off would-be pests and browsers. Through his work on *Arabidopsis*, Fink has identified some genes involved in producing these “defensins,” which could someday be used to engineer pest resistance in crops. Plants in which these genes are always turned on would be poised to defend themselves when an attack begins.

And since these compounds are the substances that have long made plants an important source of medicines, Fink says this work could directly benefit human health.—STEPHEN E. LYONS

DOWN TO THE SEA IN SQUIRTS

The three-foot yellow robot dives under the ice of New Hampshire's Lake Winnepesaukee, propelling itself by squirting a small jet of water into the cold winter air. A group of graduate students and James Bellingham, manager of the Underwater Vehicle Laboratory at MIT's Sea Grant College Program, watch *Sea Squirt* disappear as it begins a study of the ice's underside, research that could lead to ocean-monitoring experiments related to global change.

Unlike other underwater robots, *Sea Squirt* and *Odyssey*—a deeper-diving machine that Bellingham's team is completing—are small, easy-to-handle machines that can monitor conditions below water without human intervention. And the MIT robots can be built for only a fraction of the cost of most under water-monitoring vehicles. While those designed for the military can cost more than \$3 million, Bellingham says *Odyssey* can be constructed for only \$50,000.

The small size partly relates to the fact that Bellingham and his colleagues, unlike most underwater-vehicle design-

ers, simply considered this a priority. The MIT group therefore has engineered the sub-systems itself rather than buying items with unneeded components. This also lowers costs, as does the fact that the robots aren't built to handle missions such as crossing oceans.

But the devices are practical for many ocean-monitoring experiments, says James McFarlane, president of International Submarine Engineering in Vancouver, British Columbia. His company, the world's largest manufacturer of commercial underwater vehicles, has helped Bellingham's group with some labor.

Sea Squirt swims a zigzag course below Winnepesaukee, determining its position by a pressure sensor and acoustic transponders dropped on the lake's bottom. An echo sounder, like that typically used on ships, searches for rocks that might be in the way. And a “behavior hierarchy” computer program helps *Sea Squirt* continually evaluate its priorities—for example, the robot will avoid a crash in preference to taking scientific measurements. The only other way to ensure the robot's safety would have been impractical, involving a much larger computer to create a model of the vehicle's surroundings before searching for obstacles within that image, Bellingham explains.

Under Lake Winnepesaukee, *Sea Squirt* videotapes the submerged side of the ice. But the robot's other cameras and sensors also measure the water's temperature, turbidity, electrical conductivity, and chemical conditions—and from these deduce a host of still other variables, such as location of pollution plumes.

Meanwhile, Bellingham's group is

developing *Odyssey* to dive as deep as 3.75 miles, compared with *Sea Squirt*'s maximum depth of about 660 feet. The engineers are shaping the vehicle to have less drag and are hiding the robot's electronic parts in glass spheres that can withstand tremendous water pressure.

Starting this summer, Chryssostomos Chryssostomidis, a naval architecture professor and director of MIT's Sea Grant College Program, plans to have *Odyssey* videotape the depths of Boston's polluted harbor and measure the water's salinity, turbidity, and dis-



Underwater robotic vehicles such as Sea Squirt, which are small and relatively inexpensive, could be useful in a wide variety of ocean-monitoring experiments.

solved oxygen. Scientists at the Massachusetts Water Resources Authority want to determine exactly what causes the seasonal blooms of algae in the harbor.

Next winter, *Odyssey* is supposed to travel to Antarctica and take the first-ever measurements of the magnetic field of the ocean floor from under the ice. The data should help scientists fit together some final pieces of the geological theory of plate tectonics.

Another MIT Sea Grant robot that is being built based on a similar concept to *Odyssey*'s will explore the underside of the Arctic ice shield by sound waves. Henrik Schmidt, professor in MIT's Department of Ocean Engineering, says that study could be of interest to the mili-

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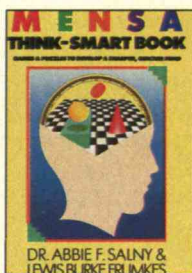
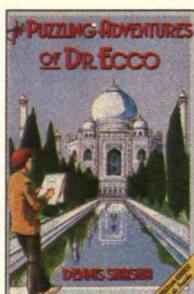
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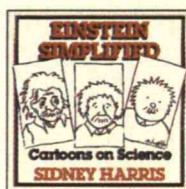


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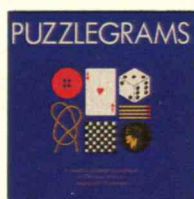
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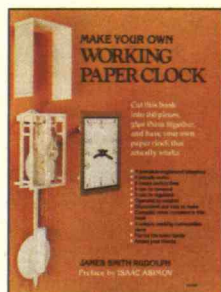


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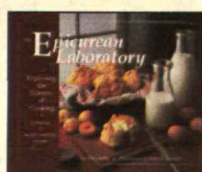
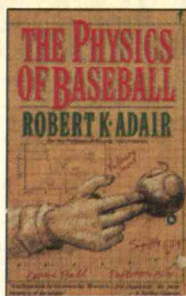


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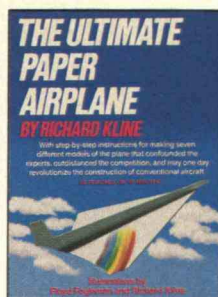
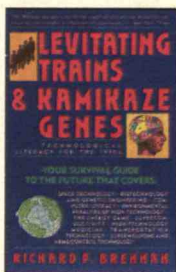
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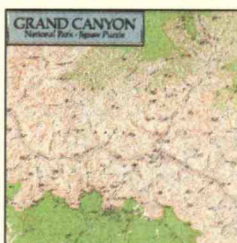
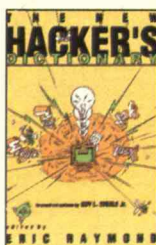


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tary because of its use of submarines below the ice. And the project could help scientists determine whether the thickness of the ice is changing over time, which could provide evidence of global warming.—MONIKA WEINER (*The author is a Knight Science Journalism Fellow at MIT.*)

PUMPING JELL-O

 Using a substance similar to Jell-O, David Brock of MIT's Artificial Intelligence Laboratory has developed an artificial muscle that contracts, relaxes, and lifts small weights. The "muscle" could help create smaller, stronger, and more flexible robots, says Brock, a doctoral student in mechanical engineering.

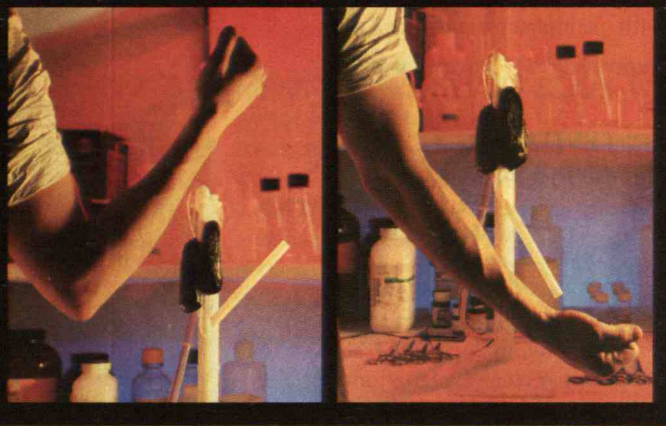
Today's robotic hands dwarf their human counterparts because of all the required gears, pulleys, and motors. An enormous arm as well as a closetful of electronics must support each mechanical hand. But Brock's muscle, which like gelatin consists of a polymer, can replace a great deal of hardware, and in a smaller package. Because it operates solely on doses of acid and base solutions, it also could lead to robots that aren't tied to electrical outlets.

Brock isn't the only engineer who has been intrigued with creating artificial muscle from polymer gels. Italian researchers, for example, are trying to develop a polymer-gel-controlled artificial sphincter for people plagued with incontinence.

Toyoichi Tanaka, professor of physics at MIT's Center for Materials Science and Technology, suggested that polymer gels could be used for artificial muscles after working out the physics of the materials in the late 1970s. Polymer gels, which consist of a tangled web formed by long chemical chains of identical subunits and a liquid trapped among the strands, rapidly change their volume following, say, tiny changes in pH or temperature. Adding an acid, for example, causes the filaments to attract one another, squeezing out the liquid between and reducing the volume. Adding a base causes the opposite reaction.

For his artificial muscle, Brock uses

An artificial muscle developed by MIT doctoral student David Brock works like a person's upper arm. By contracting and expanding, it can raise and lower a lever.



polyacrylic acid, a soft, white synthetic polymer found in some clothing. A thread-like strand is a braid of 2,000 fibers, each about 10-millionths of a meter in diameter. Brock snips the polyacrylic acid into pieces about 6 inches long, bakes them to strengthen them, ties together 50 or more strands, then soaks them in a strong base—concentrated sodium hydroxide.

The supple, slimy bundle that emerges is highly responsive to acids and bases. Squirt hydrochloric acid on it, and the "muscle" quickly contracts. Douse it with sodium hydroxide, and it expands to the original size, though a bit more slowly. By tying one end of a bundle to a fixed post and the other to a lever and then alternating squirts of acid and base, Brock can make the muscle repeatedly lift and lower a 100-gram weight.

A muscle made from polymer gel resembles its natural counterpart in many ways. Both can generate substantial force, and both convert chemical energy into motion with the same efficiency. Even more important, both natural and polymer muscles are made of bundles of fibers, according to Ian Hunter, director of McGill University's BioRobotics Laboratory. Just as all animals—from blue whales to earthworms—use the same kind of muscle fiber, all sizes of actuators (as mechanisms used for moving or controlling machines are called) might be able to rely on polymer fibers. To build robots of different sizes, "we need to do pretty much what nature has done," Hunter says.

Brock's prototype of artificial muscle must be vastly refined before it can be used in a robot. At this point, it contracts and relaxes more slowly than human muscle. Making the bundles from even thinner filaments of polyacrylic acid will cut the "twitch time" and speed the response, says Brock. Carbon fibers interwoven with the polymer could give it additional strength.

More important, a noncorrosive container must be designed that can expand and contract with the flexible polymer and deliver just the right dose of acid or base to all the strands at once. The container must also be able to drain away the salty fluid that forms from the reactions in the muscle.

A simpler design might be based on a recent idea of Tanaka's: a new polymer gel that works without needing squirts of acids and bases. Impregnated with a substance similar to chlorophyll, the gel contracts in response to light.

While research continues, contractile polymers are attracting attention. At a recent conference on novel actuators sponsored by the Office of Naval Research (ONR), Navy officials looking for new robots to replace some large, clumsy machines were impressed with Brock's artificial-muscle plans, according to Teresa McMullen, the science officer for perceptual and computer science at ONR. "Our robots need more flexibility and lighter weight," she says. "Polymer gels have the advantage of being the most muscle-like alternative."—P.J. SKERRETT

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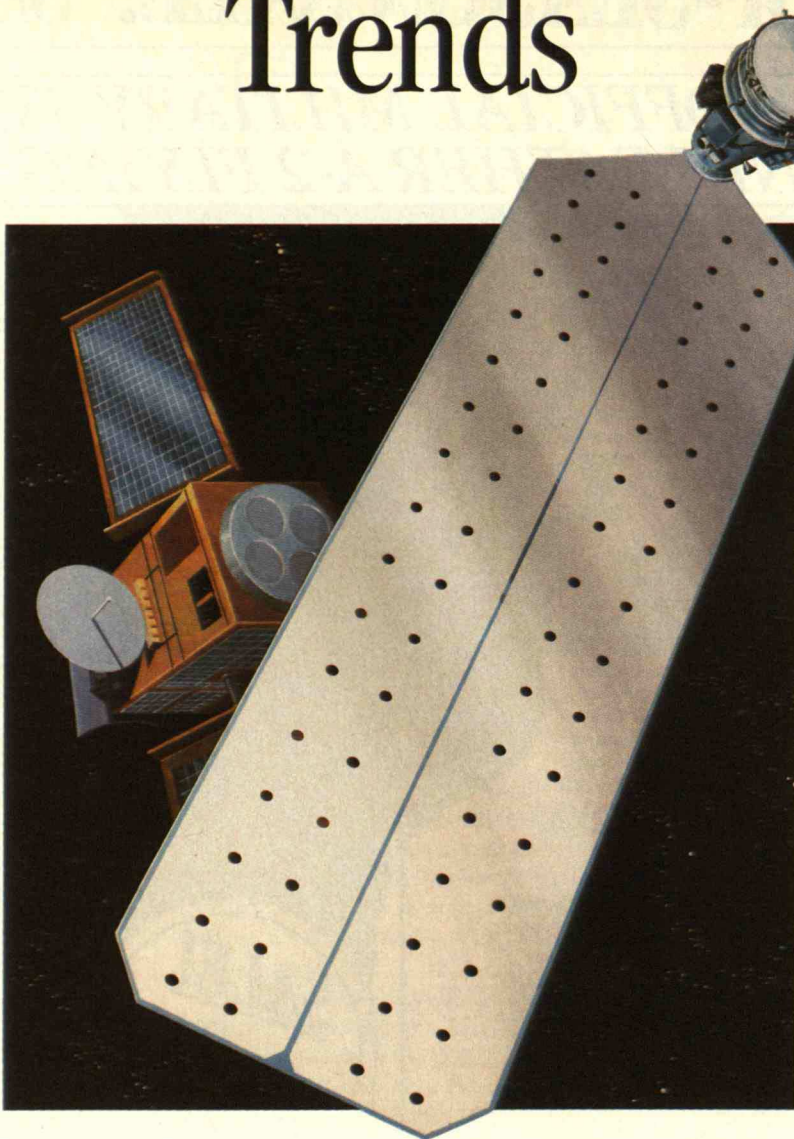
Swatting Spies in the Sky

■ The collapse of the Soviet Union may have allowed the U.S. military to pull nuclear bombers off alert and close bases around the world, but Pentagon officials are sticking to plans for at least one Cold War weapon: a missile that can destroy enemy spy satellites above the battlefield.

The anti-satellite (ASAT) missile, originally intended to blind Soviet spy satellites tracking U.S. military forces during a battle between the superpowers, is now being reoriented to other potential enemies who might launch advanced imaging satellites to gain a wartime advantage.

In the Persian Gulf War, the United States and its allies had a monopoly on spy-satellite information. Images from photoreconnaissance satellites, data from radar satellites, and radio transmissions intercepted by intelligence satellites allowed the military coalition to follow Iraqi military movements in great detail. Meanwhile, the allies' key ground attack in Operation Desert Storm—an assault from the west—took Iraqi generals by surprise because they had no spy satellites of their own.

U.S. officials warn that other nations will learn from the war that remote-sensing satellites are vital for modern warfare. They argue that the U.S. must have a satellite-killing weapon to tip the scales back in its favor. "The decisive role of space in Desert Storm was not lost on potential adversaries," says Douglas Graham, U.S. deputy assistant secretary



Like a giant flyswatter, the military's non-explosive interceptor would knock enemy spy satellites senseless during wartime but not shatter them into tiny fragments that could blind U.S. satellites.

of defense for strategic defense, space, and verification policy.

And given the increased commercial availability of remote-sensing technology, rear admiral Thomas Brooks, the director of naval intelligence, told the House Armed Services Committee last year, "any country that desires to have a space-based reconnaissance program can acquire one over the next decade."

However, ASAT critics maintain that the worries are overblown. Connie Van Praet, director of the Washington-based Institute for Security and Cooperation in Outer Space, believes that countries the

Pentagon has in mind are much more likely to go low-tech. "Space weapons will not stop a suitcase bomb," she says.

Steven Aftergood, an ASAT opponent at the Federation of American Scientists, agrees, maintaining that the nations with which the United States is most likely to go to war are not the ones with satellite technology. "Libya is not building photoreconnaissance satellites," he says.

In addition to the Commonwealth of Independent States, derived from the former Soviet Union, only four countries besides the United States now have imaging satellites: France, Japan, China, and India. But Brooks suggests that by the end of the decade nine

more—Canada, Germany, Israel, Italy, Pakistan, South Africa, South Korea, Spain, and Taiwan—could acquire them. And he maintains that some of these countries could launch satellites that can discern details as small as one meter across.

To counter this proliferation of eyes in the sky, the U.S. Army Strategic Defense Command is developing a three-stage ASAT rocket. Fearful of creating a cloud of orbital debris that could blind U.S. spy satellites, ASAT designers have developed a non-explosive interceptor that would extend a Mylar paddle, somewhat like a giant flyswatter, which would jar the enemy satellite violently enough to destroy its components but not break the spacecraft apart.

Researchers from the Army's prime contractor, Rockwell International, tested the notion in December 1991

using a half-scale model of a satellite and high explosives that created a flat shock wave to simulate the flyswatter effect. Rich Arras, ASAT program manager and vice-president at Rockwell, says the concept works: "Everything inside the satellite came loose and was broken. But it all stayed inside the satellite structure, so it didn't create any debris."

The Army's plans call for seven flight tests of the weapon starting in late 1996, two of which will strike inactive U.S. satellites, followed by deployment in 1988 of a battery of ASAT missiles at an undetermined site on U.S. territory.

But whether the weapon is ever deployed hinges on support in Congress, which has barred ASAT tests in the past because of concerns that they could violate the 1972 Anti-Ballistic Missile Treaty. After repeated congressional moratoriums in the 1980s, the U.S. Air Force killed a program to develop an ASAT missile that would have been fired from an F-15 fighter.

The Army has a long way to go in convincing congressional ASAT critics—particularly in the House of Representatives—that the weapon is needed. Although the House Armed Services Committee approved the administration's request for \$65 million for ASAT research in 1992, it warned that "providing for ASAT research does not constitute support for ASAT deployment."

Army officials maintain that the new ASAT poses no threat to the ABM Treaty because the weapon is too unsophisticated to combat incoming enemy missiles. Its relatively simple sensor can easily handle the task of finding an enemy satellite in a known orbit but would have trouble with the much more difficult task of finding a small warhead coming from an unpredictable direction.

Nevertheless, some arms-control specialists remain adamantly opposed to the ASAT system. In their view, in an era of tight budgets and pressing domestic problems, the United States has better ways to spend precious defense dollars.

—VINCENT KIERNAN (The author is a reporter for Space News.)

Crunching Symbols

It seems axiomatic: computers are designed to crunch numbers. Yet according to some iconoclasts, computers should be just as well-suited to handling a greater level of abstraction—for instance, to reducing complex fractions or manipulating algebraic symbols.

Even back in Charles Babbage's day, 150 years ago, the Countess of Lovelace, Ada Augusta, held that it was a mistake to think of Babbage's analytical engine as merely a number cruncher, when it was clear to her that the machine could easily combine and arrange algebraic expressions. And mathematician Stanislaw Ulam advised his computer-wary colleagues some 30 years ago that they should embrace the machine "as a handy device for manipulating and displaying symbols."

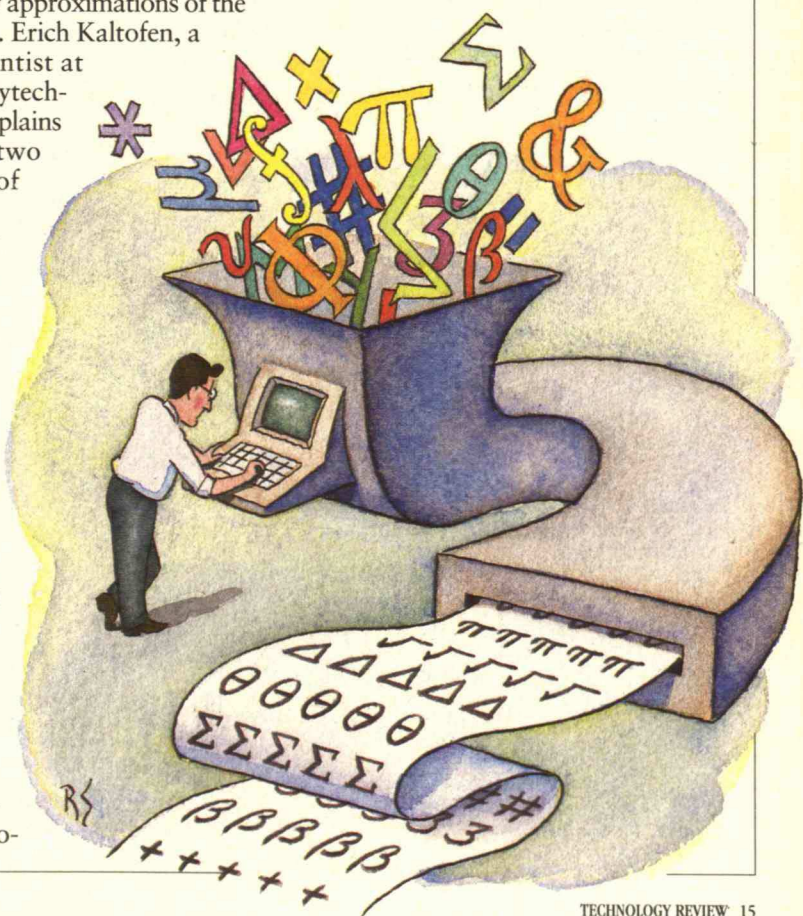
The computer as number cruncher is no slouch, of course. But the problem with number crunching is that the results are usually only approximations of the actual answers. Erich Kaltofen, a computer scientist at Rensselaer Polytechnic Institute, explains that there are two main sources of error.

First, nearly all computers rely on floating-point arithmetic schemes, which retain only a relatively small, fixed number of decimal places, in order to calculate at high speeds. The unavoidable result, however, is round-off error. Second, most computers rely on algo-

rithms that arrive at a result by iterative means, repeating a series of operations that ever more closely approximates the answer but doesn't necessarily hit it right on the money.

For most applications, from spreadsheet calculations to engineering analyses, this degree of accuracy is more than adequate. But after the millions of arithmetic operations required to model a complex scientific phenomenon, error can grow exponentially, and the final computed result may bear little relation to the actual answer. In fact, to establish confidence in computer answers to such complex problems, much effort is devoted to the numerical analysis of error.

Symbol-crunching techniques strive for exact answers by manipulating mathematical expressions. Kaltofen's colleague, David Musser, explains that in symbolic computation, integers, fractions, even irrational numbers are treated as what they are. For example,



one-third is one-third, not .333. And the square root of two is the square root of two, not 1.414.

Symbols are represented in the computer by expressions such as ratios and polynomials. A library of subroutines manipulates these expressions in ways that allow the program to combine and reduce fractions to their lowest terms, simplify, expand, or transform algebraic equations, determine derivatives and integrals, and find solutions to differential equations.

A recent report by the Society for Industrial and Applied Mathematics suggests a broad range of applications. Symbolic computation has already made contributions in celestial mechanics, chemical engineering, signal processing, and reaction-diffusion models in cellular biology. It may also contribute to several areas of mathematics, including group theory, algebraic geometry, num-

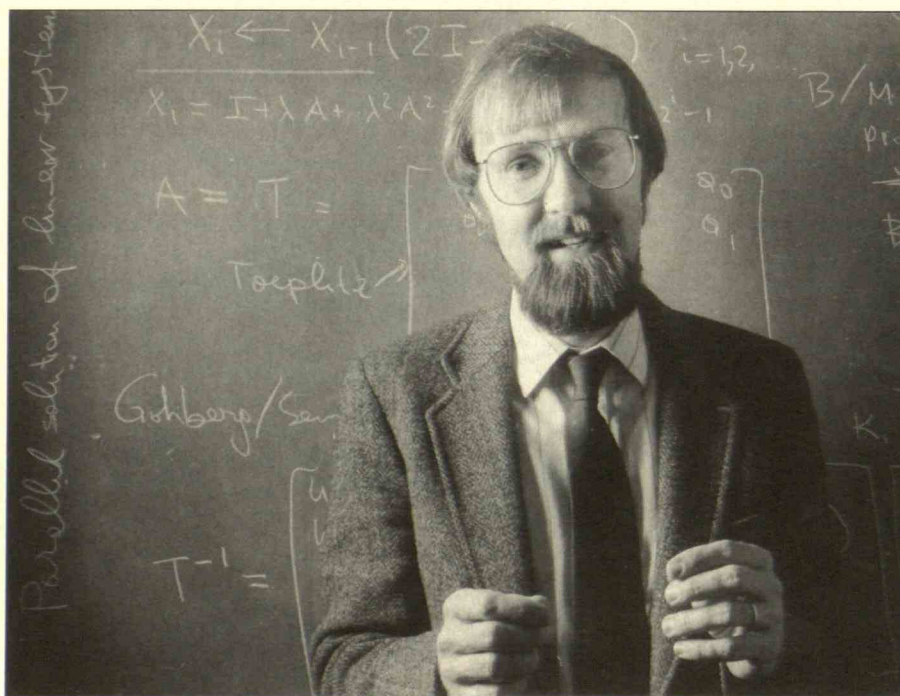
ber theory, and applied mathematics, according to the report.

Whereas early symbol-processing software had to run on large computers, new programs have been introduced for personal computers. Perhaps the most popular of these is Mathematica, developed by a team led by Stephen Wolfram, director of the Center for Complex Systems Research at the University of Illinois. Wolfram believes Mathematica is powerful enough to tackle frontier problems in science and mathematics, yet simple enough to be used by undergraduates on an IBM PC or a Macintosh.

Given the advent of such affordable symbolic systems, some believe that math education may be altered just as it was in the 1970s following the introduction of the pocket calculator. Kaltofen goes so far as to suggest that while it's important to teach students basic concepts, such as factoring of polynomials, there is no more of a reason to require pencil-and-paper exercises than there is to force students to consult log tables or practice their long division.

—DAVID BJERKLIE (*The author is a science reporter for Time.*)

Computer scientist Erich Kaltofen believes that programming computers to manipulate symbols rather than numbers could revolutionize math education.



A Women's Institute of Technology?

When anthropologist Barbara Lazarus began pondering the status of women in engineering a couple of years ago, she discovered some disturbing statistics. Despite a variety of recent outreach programs to encourage women to enter engineering school, women students still constitute only about 16 percent of undergraduate engineering classes nationally. At the doctoral level, the figure slips to less than 9 percent. And when it comes to actual practice, only 6 percent of all engineers are women.

To turn these numbers around, Lazarus, associate provost for academic projects at Carnegie Mellon University, recently proposed a separate women's engineering institute—a notion that has generated heated discussion across the country. Indeed, while some argue that such an institute would help integrate more women into a traditionally male-dominated profession, others claim that it would simply make women feel more isolated than they do already.

But the idea has been steadily gaining momentum. What began quietly two years ago as a "modest proposal" to a small audience of faculty and graduate students, grew into a paper, then a lecture at the Women Engineering Program Advocates Network, and finally a series of talks at the National Academy of Sciences and various academic advising associations. "Though the groups have usually been small, the response has been astonishing," Lazarus says. In fact, although this is only an informal proposal, Lazarus says that she regularly gets calls from women hoping to enroll in a degree-granting program.

Lazarus, a former dean at Wellesley





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College, observes that "while we have no experience in this country with single-sex engineering, we can learn from the experience of women's institutions." For instance, she points to studies showing that women's colleges surpass coed schools in producing research scientists by a factor of four to one.

"Women's colleges apparently do make a big difference," affirms Betty M. Vetter, executive director of the Commission on Professionals in Science and Technology. With more women on the faculty and an atmosphere of support, she says, "those who attend women's colleges gain one thing the rest of us don't get much of: self-confidence."

"If these women's colleges do so much for women in other traditionally male-dominated fields," asks Indira Nair, Carnegie Mellon's associate department head of engineering and public policy and Lazarus's co-author on the initial paper, "wouldn't a women's institute of engineering do the same?" The idea deserves serious consideration especially at the graduate and post-doctoral levels, she argues, where attrition rates for women are highest and where careers are often made or broken.

Patricia Hynes, an adjunct professor of urban studies and planning at MIT and director of the Institute on Women and Technology—a feminist think tank—expresses concerns about isolating women but generally applauds the idea. "Engineering will never admit equal numbers of women," she says, as long as it remains principally a "male sports culture, a fraternity where even seemingly trivial comments can create a climate of intimidation and alienation." She cites examples ranging from the male "bonding" between faculty and students that excludes or trivializes

women in the classroom to computer "hacker" pornography.

Though the argument provides sympathetic responses, many educators maintain that separation would pose problems. "I don't think it's going to get a lot of support in the community," says Eleanor Baum, dean of the College of Engineering at Cooper Union. While she believes support programs can help women advance in engineering careers, she worries that women who study apart may not learn to deal with male engineers on equal terms.

"The major issue facing women at the academic level is isolation," affirms Suzanne Brainard, director of the Women in Engineering initiative at the University of Washington. "Women's grade-point averages are equal to or higher than men's. So we're not dealing with academic issues as much as social issues: a lack of role models and a lack of

Despite support for women in coed engineering schools, they still account for only 6 percent of all engineers, leading some to conclude that a separate women's institute of technology is warranted.

mentors," she says. "So why would you set up a program or institution that further isolates women from the very people they'll be dealing with?"

Most heads of successful women-in-engineering programs at coed schools can, in fact, point to increases in enrollment and retention rates without resorting to "separate-but-equal" strategies. At Purdue, which initiated one of the country's first women-in-engineering programs in the late 1960s, retention rates for women have risen from 20 percent to more than 54 percent. Cornell, the University of Washington, the University of Michigan, and Douglass, a women's college at Rutgers University, also offer programs to encourage women students to choose engineering and stick with it.

Strategies include "big sister" programs that pair first-year women with upper classwomen, special study groups, lectures, junior and senior high school outreach programs, and separate "math and science" residence halls for women.

Yet, despite these efforts, the total number of women in engineering hasn't increased since 1983. Therefore, some say, more radical steps are in order. "A dramatic increase in the supply of scientists and engineers is required to maintain our nation's competitive posture," says Lazarus. And given that 85 percent of new entrants to the work force will be women, minorities, and immigrants by the year 2000, she says, exploring new ways to increase the number of under-represented groups is clearly indicated.—ARIELLE EMMETT



The Haze Around Environmental Audits

When historians of technology reflect on the final quarter of the twentieth century, they may well surmise that the archetypal public debate centered around the throw-away cup. Even after an environmentalist campaign convinced McDonald's Corp. to start phasing out polystyrene foam packaging in November 1990, the controversy over foam or paper, paper or foam—which to buy and which to banish to the bogeyland of the environmentally verboten—has not gone away.

Nor does it appear that the debate will be settled any time soon. Indeed, to try to resolve such issues, scientists began to produce cradle-to-grave analyses—what have become known as an “environmental audits”—to consider all the costs and environmental effects related to the production, recycling, and disposal of a product. But this process has proven to be so fraught with ambiguity that many experts are now questioning whether environmental audits can ever produce meaningful product comparisons. The paper-versus-foam debate, critics say, proves the point.

In a much-publicized article that appeared in the February 1991 issue of *Science*, Martin Hocking, a chemistry professor at the University of Victoria in British Columbia, compared the two types of cups and arrived at what seemed like a surprising result, especially in the wake of the McDonald's decision. In his quest “to get people to think about a number of factors besides whether the cups had chlorofluorocarbons in them,” Hocking was led “to the inevitable conclusion that foam cups are the environmentally better choice from a range of standpoints.”

The most striking feature of the original paper was Hocking's contention that even though foam cups were made out of petroleum, production of their paper cousins using the most common paper-mill technology consumed considerably more of it. On average, he

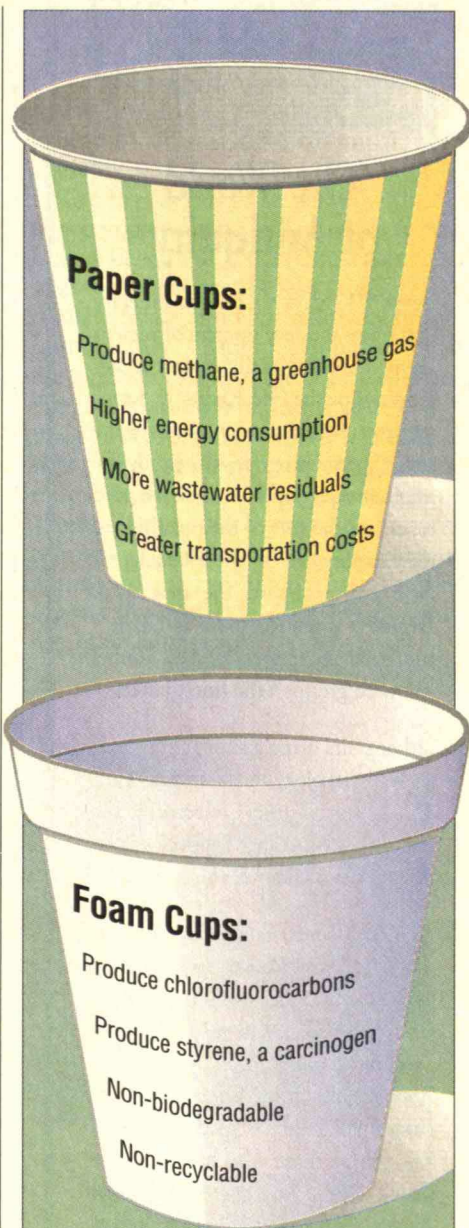
said, fabricating a paper cup burned up 4.1 grams of petroleum, while a foam cup consumed 3.2 grams. Production of one paper cup consumed 12 times as much steam, 36 times as much electricity, and twice as much cooling water as a foam cup. And this ignored transportation-fuel costs related to the fact that a paper cup weighs nearly seven times more than its foam competitor: 10.1 grams versus 1.5 grams.

Since publication, Hocking's analysis has been subject to blistering attack. For instance, Henry Wells, Jr., professor of paper science and engineering at the University of Minnesota, claims that the Canadian professor overlooked the fact that the energy that runs a paper mill comes from burning waste wood rather than petroleum. And Neil McCubbin, a Quebec-based consultant whose 1982 report Hocking relied upon extensively to generate his numbers, claims that although he estimated that a typical mill would use 1.5 to 2 grams of hydrocarbons per paper cup by 1990, Hocking cited twice that amount. McCubbin further claims that the report Hocking used to estimate the water-borne pollutants generated by paper mills was woefully out of date, quoting figures from mills of the late 1970s, which did not use modern water-treatment facilities.

The American Paper Institute (API) notes that Hocking failed to factor in the environmental effects of styrene, a carcinogenic by-product of foam production. API estimates that two-thirds of the 43 million pounds of styrene produced in the United States every year is used to make polystyrene.

In Hocking's defense, David Heeney, a partner in the Toronto environmental policy consulting firm of VHB, finds that for all its flaws, Hocking's analysis “was notable because it was placed in the public domain and it published the sources of the data.” Most companies are coming to view such life-cycle data as proprietary, he says.

But in the end, analyses like Hocking's are more often criticized for what they leave out than praised for what they include. “The main question is



Paper versus foam: Chemistry professor Martin Hocking's original attempt to determine which type of throwaway cup is superior—based on environmental factors (above)—generated a storm of protest. Critics argue that the criteria used in these kinds of cradle-to-grave environmental “audits” are so open-ended that when held up to closer scrutiny few conclusions hold water.



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how do you define the system: What are the beans that we are counting, and how are we counting them?" says Allen White, director of the risk-analysis group at the Tellus Institute, a nonprofit environmental policy research organization in Boston.

White suggests that a more complex analysis might have tried to compute the energy use of the chain saws that cut the trees and the trucks that haul the logs. Going yet further, why not examine the environmental impact of the manufacturing processes that produce chain saws and trucks?

The difficulty of defining a chain of production and its potential side effects leads White to suggest that a cradle-to-grave analysis that compares different technologies may be inherently too open-ended. He believes it makes more sense to do the studies within a given industry—such as the paper-cup industry—and limit analysis to which product or process uses less material and energy and, therefore, is environmentally more benign.

Other experts believe that environmental cross-product comparisons do have a place because significant differences between technologies do exist. "The worst bike is undoubtedly better for the environment than the best car," says Heeney.

But according to Bruce Vigon, a senior research scientist at the Battelle Institute's Environmental Technology Division in Columbus, Ohio, the Hocking paper shows that any such studies must be done with more rigor than in the past if they are not going to become objects of ridicule. This means requiring researchers to describe in some detail their assumptions as well as the sources for their data.

The need to make cradle-to-grave audits more scientific prompted the U.S. Society of Environmental Toxicology and Chemistry last year to form a committee to suggest how such studies should be conducted in the future.

—STEPHEN STRAUSS (*The author is a science writer for the Toronto Globe and Mail.*)

Insects in Deep Freeze

After facing frigid temperatures, sometimes for long stretches during the winter months, certain hearty insects emerge in springtime completely unscathed. Though biologists have long observed this feat, several groups are now studying how it is accomplished in the hope of developing more effective ways to preserve organs for use in medical transplants.

One study, conducted by John G. Baust, director of the Center for Cryobiological Research at the State University of New York, focuses on the larva of the goldenrod gall fly (*Eurosta solidaginis*), which lives in the stem of the goldenrod plant. Like hundreds of thousands of other so-called "overwintering" species that survive winter in the Arctic, Antarctic, and the north and south temperate zones, the gall fly larva produces "cry-



oprotective" compounds that prevent it from freezing to death.

The gall fly's cryocompounds, glycerol and sorbitol, actually prevent the formation of ice, which is the real concern for the living cells. "It may be that ice crystals penetrate and freeze the inside of the cells," says Ken Storey, a cryobiologist at Carlton University in Ottawa, Canada, "or it may be that, as ice forms, it causes ions and other molecules to concentrate within the cell. Either one, or both together, can kill cells."

Baust's team recently found a promising combination of natural compounds that hardens into a glass-like substance at low temperatures. "Instead of forming ice at freezing temperatures, the entire system remains a 'brittle liquid,' like window glass," says Baust. "The goal is to form a glass within an organ so the disruptive changes that normally

happen when ice forms will not occur."

The vitrification process could be induced with a glycerol and sorbitol solution identical to that produced by the gall fly. But the concentrations required would kill human cells. Baust discovered that a mixture of low percentages of glycerol and sorbitol, both sugar alcohols, and two sugars (fructose and trehalose) is able to "trick" water molecules into aggregating with the solution to form a glass rather than ice.

So far, the successes with freezing cells only include collections of like cells. Simple cryoprotective compounds are now used to preserve cells in blood and sperm banks for several months or years. For instance, red blood cells are frozen in a solution of salt water and glycerol, and sperm cells are frozen with glycerol to prevent ice from forming.

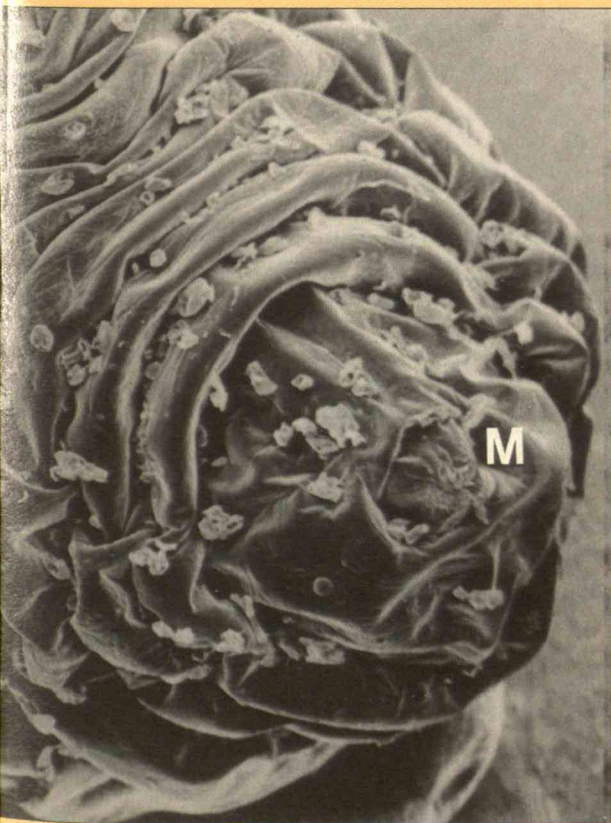
Organs, on the other hand, can be preserved for just a few hours at a time.

"One of the problems with going from cells to a whole organ," says Baust, "is that organs are composed of many different kinds of cells, which makes the procedure of freezing them much more complex."

The first organ to be tested with this new cryocompound will most likely be a kidney because it is the least sensitive to low temperature, is less fragile, has resilient tissues, and has relatively simple functionality. "Right now, kidneys last the longest outside of the donor—longer than hearts and livers," adds Storey.

Cryobiologists are also looking at other overwintering creatures, such as frogs, to find more cryoprotectant agents. If they discover the right compounds and combinations for various organs, we may soon see warehouses of organs suspended in deep freeze ready for transplantation.

—PATRICIA BARNES-SVARNEY



The goldenrod gall fly larva (magnified at left) avoids freezing to death while hibernating inside a goldenrod "gall ball" (right) by producing compounds that prevent the formation of ice crystals, which can puncture and destroy living cells. At low temperatures, these "cryoprotective" compounds transform the larva's internal fluid into a brittle liquid, like window glass, that does not disrupt the cells. Scientists are trying to copy the process in the lab, with hopes of preserving organs over long periods for use in medical transplants.





Building a New Economic Order

CONSIDER the extraordinary success of the U.S. aerospace industry. From 1980 through 1986, U.S. manufacturers accounted for 80 percent of worldwide sales of commercial aircraft. The sector, which produces missiles, rockets, and satellites as well as planes, contributed \$21 billion to the nation's trade balance in 1990 and doubled its share of U.S. manufacturing sales from 1977 to 1986.

This success is a direct result of a massive public commitment. Since the birth of the aircraft industry in the early 1900s, the government, in concert with the industry's leaders, has practiced an industrial policy almost unparalleled in the modern world.

Especially notable is the role govern-

*The nation
needs a visionary
technology policy
that deemphasizes
defense and focuses
on the environment,
public health,
and community
stability.*

ment played in eras when the industry might otherwise have folded—after World War I, during the Depression, and following World War II. Spurred by the desire to ensure a steady supply of advanced military aircraft, the Pentagon invested massively in R&D, funded plant construction and modernization, guaranteed markets, bankrolled bailouts for troubled firms, underwrote employee training, protected companies from foreign competition, and promoted exports. Not surprisingly, this formidable public investment has paid off handsomely in new technologies and competitive advantages for the “ACE complex”—aerospace companies and the communications and electronics industries that sup-

BY ANN MARKUSEN AND JOEL YUDKEN

In marked contrast, industries such as steel, machine tools, tractors, autos, and consumer electronics, lacking the government nurturing afforded military-related sectors, have seen their niches invaded by competitors from rich and poor nations alike. Faced with uncertain markets and public-sector indifference, these industries have had difficulty obtaining long-term, low-interest capital for both R&D and modernization.

For 50 years, Americans have devoted the lion's share of the country's surplus wealth to pursuing national security and developing the technologies demanded by the Cold War. But while DOD lavished funds on military infrastructure, public investment in highways, sewers, and mass transit tumbled.

Although taxpayers fund the nation's technical investment, decisions about the direction of research are hidden deep within bureaucracies. Frank Press, president of the National Academy of Sciences, laments that "it is astounding but true that nowhere...is there an evaluation of the complete federal budget for science and technology and its overall rationale in terms of national goals."

Today the United States must not only make its goals for science and technology more explicit; it needs to overhaul them. A systematic economic-development strategy should aim at improving the quality of life and producing a healthy environment rather than honing the arsenal of destruction. We do not mean environment in the narrow sense of grass, rivers, and clean air, but rather living and working environments—from housing to factories and offices to recreational and wilderness spaces. An economy that is nurturing rather than destructive, devoted to public health, clean and sustainable physical surroundings, and a stable community and work life, would be both more productive and achieve a higher standard of living.

A Closet Industrial Policy

The scale of the U.S. commitment of public resources to the ACE complex has been astounding. While the United States protests subsidies for Airbus, the Europeans' jointly produced commercial jetliner, the U.S. government has itself pursued an industrial policy without which Boe-

ing and McDonnell-Douglas would never have gotten a jet off the ground. (See "The Birthing of Aerospace," page 29.)

In 1956, for example, in the midst of the first Cold War buildup, the government financed 87 percent of the aircraft industry's R&D, accounting for big chunks of companies' sales, and therefore profits. This support has continued: in 1988, military aircraft, missiles, and spacecraft accounted for 80 percent of the industry's sales. Thanks to such support, aerospace continues to be the top U.S. performer in R&D—in 1989 the government provided almost \$16 billion of the industry's \$19 billion in research funds. In fact, the ACE complex received 81 percent of all federal funding for manufacturing R&D that year.

The Pentagon has been vigilant in shaping competition in the aerospace industry, carefully spreading around contracts to ensure the prosperity of each major firm. The Pentagon has also continually bailed out companies in trouble. Between 1958 and 1973, the government undertook some 3,652 rescue operations. Douglas, for example, garnered some \$75 million in aid in 1967 when in serious trouble with its DC-8 and DC-9, while Lockheed received a \$350 million loan guarantee in 1971. This closet industrial policy is still alive and well: the Bush administration recently asked Congress to appropriate \$1 billion in loan guarantees for overseas customers of U.S. military contractors—the first time such aid has been requested since the 1970s.

Like aerospace, the electronics and computer industries have found safe harbor through government contracts. While federal purchases accounted for at least 70 percent of sales in the 1950s and early 1960s, even today computer firms vie for enormously lucrative government contracts. In 1987, for instance, IBM, AT&T, and Digital Equipment competed for a \$4.5 billion Air Force deal for 20,000 office minicomputers, part of a fiscal-1988 federal information systems budget totaling \$17 billion. And the Pentagon continues to fund much of the industry's basic research through efforts such as the Sematech consortium, to which the military contributes \$100 million yearly, and the Strategic Computing Program.

Unfortunately, the vitality of the ACE complex has been purchased at the price of stagnation in the rest of the civilian industrial base. The gap in R&D funding is substantial: while aerospace, communications, and electronics garnered \$23 billion in federal research funds in 1989, the steel industry received a minuscule \$21 million. Thus it's no surprise that while electronics, instruments, and nonmotor vehicles—the latter dominated by aircraft—increased their shares of U.S. manufacturing by 12 to 22 percent during the defense buildup of

ANN MARKUSEN is professor of urban planning and policy development at Rutgers University and director of its Project on Regional and Industrial Economics (PRIE). She is coauthor of *The Rise of the Gun Belt* (Oxford University Press, 1991). JOEL YUDKEN, a postdoctoral fellow at PRIE and a specialist in technology policy, was formerly program director at the Center for Economic Conversion and a defense engineer at Lockheed. This article is adapted from *Dismantling the Cold War Economy* (©1992 by Ann Markusen and Joel Yudken), to be published in April by Basic Books.

1979 to 1986, the shares of industries like steel, autos, and apparel dropped by 14 to 40 percent. Although aircraft posted a trade surplus of \$12.5 billion in 1987, instruments \$3.0 billion, and computers \$1.0 billion, iron and steel showed a negative trade balance of \$18.5 billion, apparel \$16.9 billion, and motor vehicles \$53.3 billion. Indeed, adverse balances in steel, autos, textiles and apparel, and electronics other than computers accounted for more than three-quarters of the U.S. trade deficit.

The Limits of Dual Use

Although the Pentagon has sponsored what many economists see as a second Industrial Revolution, this revolution appears to have run its course. Military technology, once considered the principal spur to commercial innovation, is now widely perceived as falling significantly behind its commercial equivalent. For example, the expensive VHSIC (very high speed integrated circuit) program, funded by the Defense Advanced Research Projects Agency (DARPA), is only marginally relevant to the needs of commercial semiconductor producers.

In response to the weakening link between high levels of military R&D and commercial economic vigor, a loose coalition of military and civilian high-tech leaders has begun promoting a new industrial manifesto, dubbed "dual use." Concerned about the declining domestic availability of high-tech military components, these leaders argue that the Pentagon should explicitly support R&D with both military and commercial potential, thereby tying the nation's technology base more closely to military needs.

DARPA has established a niche as the DOD's flagship agency in fostering a dual-use technology policy. One of its major efforts is the \$1 billion Strategic Computing Program, possibly the nation's most ambitious computer R&D effort ever. Reputedly a response to Japan's Fifth Generation Computer program, this research has not been as successful as the Pentagon had hoped in developing practical uses for artificial intelligence. Still, DARPA claims success in commercializing the new generation of superfast parallel-processing computers.

More explicitly on the commercial front, DARPA has spent \$100 million each year since 1988 to help fund Sematech, the consortium established to restore the semiconductor industry's competitiveness. Other dual-use DOD initiatives, funded by DARPA or inspired by it, include projects in hypersonic aircraft technology, high-performance turbine engines, advanced composite materials, x-ray lithography, high-definition television, machine tools, optoelectronics, and computer-based



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The industries in the "ACE complex"—aerospace, communications, and electronics—have long enjoyed, and profited from, the lion's share of federal R&D funding.

FEDERAL VS INDUSTRY R&D FUNDING IN 1989

INDUSTRY	FEDERAL FUNDS	INDUSTRIAL FUNDS	TOTAL FUNDS	FEDERAL % OF TOTAL R&D	% OF FEDERAL FUNDS
Total manufacturing	29,233*	59,648	88,871	32.9	100.0
Aerospace	15,647	3,511	19,157	81.7	53.5
Electronics, communications	7,928	10,618	18,546	42.7	27.1
Rubber products	313	930	1,243	25.2	1.1
Autos, trucks, railroad equipment (including tanks)	1,982	9,431	11,413	17.4	6.8
Scientific instruments	991	5,531	6,522	15.2	3.4
Machinery (including computers)	1,669	10,457	12,126	13.8	5.7
Fabricated metals	73	732	805	9.1	0.2
Iron and steel	21	601	622	3.4	0.1
Chemicals	381	11,134	11,515	3.3	1.3
Petroleum products	21	2,068	2,089	1.0	0.1
Food and beverage	0	1,172	1,172	0.0	0.0
Paper/pulp	0	1,009	1,009	0.0	0.0
Textiles	0	176	176	0.0	0.0

*In millions of dollars

manufacturing technologies. Together these efforts constitute a deep penetration by the military into almost every high-tech frontier and could have a profound impact on the nation's industrial future.

With a reputation in Congress as one of the most effective organizations in the Pentagon's labyrinthine bureaucracy, DARPA has seen its budget double since 1985, reaching over \$1.2 billion in fiscal 1990 and rising to nearly \$1.5 billion in 1991. However, the agency's continued role in pursuing a dual-use technology policy depends on a fragile coalition of interests. In 1989 the Office of Management and Budget ordered DARPA to stop funding several major projects, including high-definition television and x-ray lithography, because they were too closely linked to civilian rather than military objectives. OMB reportedly wanted to withdraw support for the Sematech consortium as well. The Bush administration has strongly opposed dual-use investment, although a recent White House report supporting an explicit technology policy and growing interest in a "critical technologies" list may signal a change of heart.

Yet even if DARPA's support continues, serious flaws in the dual-use strategy mean trouble ahead. Although an explicit technology policy may appear to be a breath of fresh air, especially one that reconciles military and civilian needs, it may actually hinder the transfer of tech-

nologies in areas of greatest commercial and national need. That's because dual use is unlikely to target manufacturing sectors now suffering from a dearth of R&D funding, including steel and textiles. Not all important areas of scientific inquiry will necessarily meet the test of military relevance, nor would such a policy address critical national needs such as mass transportation, renewable energy, occupational health and safety, and education. A narrowly conceived military/high-tech agenda cannot build more housing, clean up the environment, or upgrade the nation's infrastructure.

An emphasis on state-of-the-art innovation would also divert resources from incremental improvements in process technologies and product design, areas that help support local and regional industry. In fact, it is at this middle ground that military and civilian interests diverge most strongly. For example, DARPA's test of a state-of-the-art parallel-processing chip for a smart missile would not remotely resemble industry's methods for evaluating the chip's potential for desktop computers.

In the final analysis, DARPA is an agency with a military mandate. Although the agency prides itself on links with commercial industry, the primary users of its products are the military and intelligence communities and their contractors. In fact, during the 1980s, DARPA was forced to tie its programs more firmly to military objec-

tives and shift its budget toward applied R&D. In any case, DARPA spends only 3 percent of the Defense Department's R&D funds.

The powerful visions of promoting military security and conquering outer space were instrumental in building U.S. technological leadership and boosting the ACE complex to prominence. Visions of an environmentally sound, healthy, and stable society—without the pretense and hindrance of “dual use”—could be equally powerful in shaping the next round of technological investment.

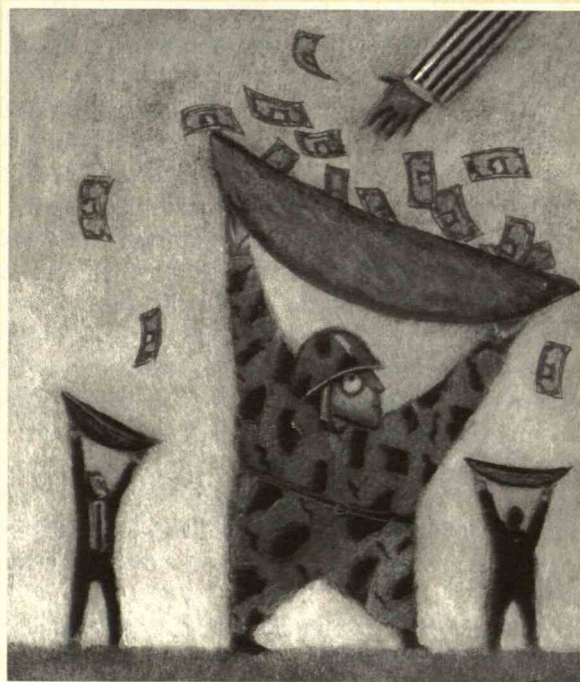
Toward a Nurturing Economy

A new U.S. economic order would aspire to stimulate technology and create demand in three basic areas. The first is “environment”: clean air, clean water, a protected biosphere, preservation of wilderness, and judicious use of scarce natural resources, from agriculture to industry to households. Public sentiment as well as an impressive body of scientific research clearly favor a new set of rules governing the interaction between people and nature. The content and effectiveness of these rules will be largely determined by how much further research, new investment, and regulation we can muster.

Health, the second category, has received generous public resources for R&D and health services for the elderly and poor. But as in defense, this funding has overemphasized costly and esoteric technologies instead of focusing on preventive care.

Community stabilization would be an essential third pillar of a new economic order. Champions of the market and rapid capital mobility ignore the destructive effects of sudden changes on workers, households, local governments, and regional businesses. Shifts in the economic environment entail real costs in the form of lost incomes, plunging property values, and shrinking numbers of customers. More subtle but just as important are the losses in well-being associated with the weakening and breakup of communities. Both types of costs can paralyze the economy, making restructuring impossible.

Governments worldwide, including those in the United States, have long accepted the need to intervene to stabilize communities when market economies deviate from desired paths of growth. The Tennessee Valley Authority rebuilt the battered economy of the south-central United States in the 1930s. During World War II, government planners attempted to match new defense plants with pools of unemployed Depression-era workers. In the 1960s, the Kennedy administration tried to stem migration from Appalachia by encouraging growth and stabilization in its key cities. In the 1970s,



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the Nixon administration redistributed federal funds to suburbs, while President Carter launched a national urban policy to reverse the decline of many central cities. Despite their critics, many of these projects worked. The Tennessee Valley is an economic success story today, boasting new Japanese auto plants and diversified agriculture.

The past decade, which saw farms and factories folding in unprecedented numbers, has forced governors, mayors, and city councils across the United States to act to strengthen local and regional economies. These communities have funded bold experiments in industrial retention, technology transfer, and entrepreneurial aid.

But piecemeal approaches, lacking the powerful framework and cradle-to-grave financing provided by the Pentagon, have not been able to replicate the performance of the military-industrial system. State and local governments simply don't have the resources to fund large-scale industrial initiatives, alternative-use planning, major R&D programs, and broad infrastructure projects. Such efforts need federal help, especially as the nation faces new rounds of defense-plant and military-base closings.

A strategy for achieving such a new economic order would, in the broadest sense, be an economic conversion plan. It would create demand for socially desirable products, provide R&D funds to enable firms to produce competitive goods, and offer technical assistance for financing conversion efforts. It would create institutional mechanisms that facilitate worker and community involvement in these activities, and fund education and job-training programs to assist employees of all types in making the transition.

Agencies such as the proposed National Institutes for the Environment and a civilian technology agency would wean the nation's R&D resources from a predominantly military patron. Investments in priority areas, such as public infrastructure, transportation, and energy, would be guided by the extent to which they contribute to a higher-quality environment, healthier population, and economic stability. Research on non-toxic manufacturing processes, for example, would receive significant funding.

Government incentives and seed grants could go a long way toward spurring entrepreneurs to respond to new market opportunities. Just as they have done for defense industries, "demand pull" forces would convince companies to invest in recycled materials, cleaner plants, alternative fuels, and large-scale infrastructural systems.

Companies like McDonnell-Douglas have had little incentive to pioneer in mass-transit vehicles, even small-scale assembly operations, partly because the domestic

The Birthing of Aerospace



From its origins
early this century, the
aircraft industry has
gained preeminence
through a rich
government diet.

THE aircraft industry, the core of what has become aerospace today, can claim a unique history. To an unprecedented degree, it benefited from cooperation among a relatively small number of firms, garnered government patronage, and engaged in extraordinary boosterism. And because the industry's infancy and adolescence occurred during wartimes, it developed a top-down direction that has characterized few other segments of U.S. business.

The Army Signal Corps ordered its first plane from the Wright brothers in 1908. German and Allied use of aircraft during World War I convinced the government to rush-order 25,000 more planes. By 1918 the United States had spent \$350 million to make 14,000 military aircraft, employing 175,000 people in the process.

The country's industrial landscape was then dominated by big trusts involved in oil, steel, chemicals, and banking. The innovative sector was the small but booming auto industry, awash in Henry Ford's fantastic commercial success in mass-producing cars on an assembly line.

Virtually from birth, the aircraft industry was distinguished from these industrial siblings. Threatened by intense competition and the specter of bitter patent fights that might delay wartime pro-

duction, the young industry benefited from a government-initiated trade group, the Manufacturers Aircraft Association, that pooled patents and shared plane-making techniques. The association quickly became the industry's voice promoting defense preparedness.

In the 1920s the industry was kept afloat by the Air Mail Act, which greatly expanded government aircraft orders. Thanks to this new demand, "civil" began to exceed military airplane production. However, plane makers' dreams of a passenger business akin to that supporting the railroad and shipbuilding industries were dashed by public indifference and the prohibitive cost of flying, especially as the Depression set in. Government orders continued to supply at least two-thirds of the manufacturers' business, accounting for 90 percent of Douglas Aircraft's income in 1933, for example.

This patronage effectively put a small handful of firms at the top of a highly concentrated industry. As early as 1930, 10 airframe companies received 90 percent of the military's business, and just 2 companies made military aircraft engines, mostly on non-competitive bids. Not surprisingly, the youthful oligopoly made spectacular profits, often the subject of public outcry and congressional investigation.

From Hot War to Cold War

World War II was a watershed, bestowing upon the industry the success, size, and solidity that was to make it a leader of the U.S. economy for the next half-century. From a small set of plants producing 17,000 planes in 1940, the industry swelled to make 96,000 airplanes in 1944, accounting for 12.4 percent of all manufacturing employment. The individual firms that were to form the backbone of the "ACE complex" (aerospace, communications, electronics) became giants on this rich government diet. North American (now Rockwell), for example, expanded from a single plant employing 6,000 in 1940 to five plants with 92,000 workers in 1943. To build this capacity, North American pulled in \$79 million in government investment on top of a modest \$5 million in its own funds.

The immediate postwar period thrust the existing aircraft makers, so recently bloated with government orders, into severe recession. Sales imploded from a wartime peak of \$16 billion to \$1 billion by 1947, and employment fell from over 1 million to a low of 237,700 in 1948. To enhance their prospects, the companies revived their interwar insistence on a policy to promote U.S. air power. Calling their agenda "Air Power for

Peace," the industry campaigned for a public commitment to air defense, expansion of domestic and international air transport, and the preservation of a strong aircraft industry. Close ties with military strategists helped shape military markets and government notions of defense requirements. These efforts paid off: the aerospace industry quadrupled its share of the nation's manufacturing value-added between 1947 and 1954, and by 1958 it again employed nearly 1 million workers.

At the close of the second decade after the war, the Cold War economy accounted for 10 percent of U.S. personal income and 20 percent of the nation's manufacturing output, providing livelihood for 12 to 14 million Americans (including two-thirds to three-quarters of U.S. scientists). The linchpin of this economy was the ACE complex, which acted as a powerful force institutionalizing the Cold War. This, in turn, served as a rationale for expanding the complex further.

The lesson is clear. A sustained government commitment to a public mission can generate new technologies and comparative advantage for U.S. industry. A purposeful, visionary program that focuses on the environment, public health, and community stability could produce similar results.—*Ann Markusen and Joel Yudken* ■

market has been so small. Imagine the difference if such a company could compete for design and manufacturing contracts prompted by a new national commitment to mass transit. A policy to develop benign forms of renewable energy, such as the ocean-thermal platform once suggested as an alternative product for Massachusetts' Quincy Shipyards, would provide other options for converting military shipyards and aircraft facilities.

As in World War II, government would match its initiatives with existing labor pools and under-used industrial capacity, and trade policies would help manage the transition instead of exposing workers and communities to instant economic death. Negotiators would require other countries to match U.S. standards on wages, benefits, and environmental protection rather than allowing exploitive conditions elsewhere to produce human misery and false competitive advantage. Domestic-content rules, similar to those that now guide defense expenditures, would ensure that local businesses and workers would be reemployed as well as encourage technology transfer back to the United States.

Negotiating the Strategy

To make a new national strategy work, many different sectors—including public-interest groups, labor, academia, business, and government—will have to collaborate and provide leadership. Coalitions of such groups have been springing up all over the country. For example, the Campaign for Responsible Technology, founded by environmental and labor groups, has challenged Sematech to include reducing toxic exposure and providing high-level jobs in its R&D agenda.

To deal with plant closures, several dozen coalitions of local governments and labor, community, religious groups have formed the Federation for Industrial Renewal and Retention. FIRR members like the Tri-State Conference on Steel have pioneered institutions such as the Pittsburgh-area Steel Valley Authority, a public entity with powers of eminent domain and technical-assistance funds to prevent plant closings. The Tri-State group is now working on a major demonstration project for a regional "maglev" (magnetic levitation) rail system using locally built components.

Plant-closing coalitions have matured into econom-

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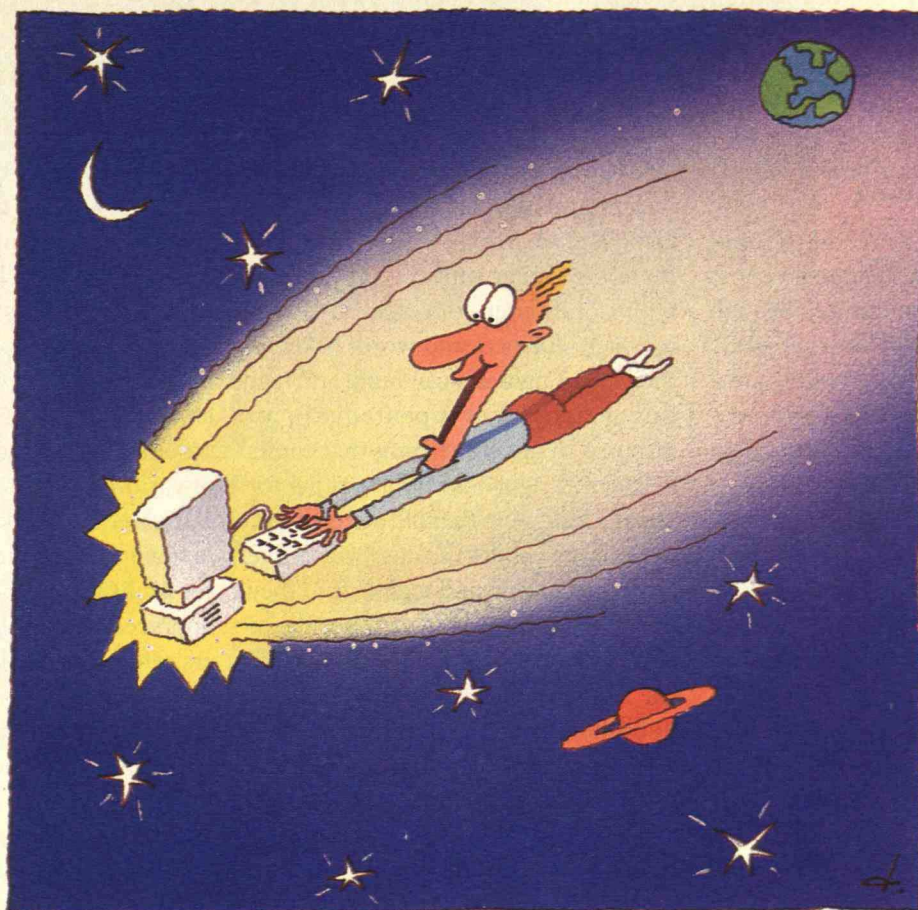
ic-development organizations. RedZone, a new Pittsburgh-based company spun off from DOD-sponsored research at Carnegie-Mellon, makes robots that clean up toxic and radioactive sites and detect buried pipelines and wiring. The Steel Valley Authority is helping RedZone find suppliers in nearby towns and obtain financing.

Experiments that involve workers in the design of new technology, important to a national strategy and common in Scandinavian and other European countries, are beginning to gain currency in the

United States. The Massachusetts Center for Applied Technology has provided technical assistance to small and medium-sized businesses that encourage work force participation. The International Association of Machinists and Aerospace Workers proposed and lobbied hard, if unsuccessfully, for a Technology Bill of Rights during the early 1980s. The AFL-CIO has recently convened conferences that address the interaction between technology and work.

Support from scientists and technologists will be crucial in making a national development strategy work. Computer Professionals for Social Responsibility is spearheading an ambitious effort, called the 21st Century Project, to reorient the nation's R&D toward solving social goals. In a related move, the American Physical Society, the Institute for Electrical and Electronic Engineers, and other professional societies have formed the Coalition for Science & Technology in a New Era. The Association for Computing Machinery, the leading organization of computer scientists, has identified the environment, energy, and health as important areas for research that responds to social needs. And Economists Against the Arms Race, with five Nobel Prize winners on its board, is promoting discussion of alternative economic-development strategies.

Despite such encouraging efforts, the United States is a long way from enjoying the cohesive and effective leadership needed to achieve the national strategy we and others envision. But the thawing of the Cold War and the growing weakness of the U.S. economy, together with mounting social and environmental problems that existing strategies have so far failed to reverse, may demand a dramatic change of course toward a truly new economic order. Achieving it will require bold initiatives guided by strong, diverse leadership and backed by a committed, well-informed public. ■



The Pleasure Machine

*Why do people get such a thrill from using computers?
How can this "ecstasy" help guide the industry?*

MY sons have progressed through many of the usual childhood obsessions—Matchbox cars, Legos, trains, bicycling, marbles, baseball. They, like millions of other children, have taken to these low-tech activities with energetic glee. In fact, I thought for a while that our family was going to maneuver through the child-raising years largely unaffected by the technological revolution swirling around us.

Fat chance. By the time my oldest son was 5, he had discovered my old IBM PC. Now 8, he steals up to my attic office at every opportunity, boots up, and goes to work. He writes. He plays games. He creates bar charts. He squeals with delight when a new program enters the house, and he even creates little programs of his own to do common word-processing tasks with a keystroke or two. He proudly shows off his mastery of the machine

to peers and adults, and passes on his knowledge to his younger brother, who now exhibits similar (though admittedly less intense) enthusiasm. In fact, when sitting at the keyboard, my son experiences a high-energy euphoria that I can only describe as a state of ecstasy.

What's going on here? My family isn't an aberration. Teachers report that children who can't sit still through a 10-minute lecture on fractions remain transfixed by a computer game for hours. In the grown-up world, people who started using computers to speed up routine tasks find themselves smitten with the machine's power, spending an ever larger fraction of their day—and their budget—on software. Novice programmers sit down at the screen after dinner and become so engrossed constructing a program that they don't look away until midnight.

Most discussions of computers focus on their utility. Do they increase productivity? Are tasks done better, or quicker, or both, with a computer than without one? What's less often noted is that many people see computers not just as a practical tool but as a source of pleasure.

In the popular mind, the phenomenon of computer-driven ecstasy means intense, greasy-haired characters who spend their waking hours at a terminal, seemingly nourished only by soft drinks, junk food, and the ethereal glow of the screen. In this milieu, they are in general retreat from life into a synthetic world of acronyms and unintelligible syntax.

But the phenomenon with greater ramifications captures people who are not typical computerphiles: doctors, professors, musicians, writers, children. They do not set out to become computer experts, or even hobbyists. Typically they begin using a computer—almost always a personal com-

puter, such as a Macintosh or an IBM-compatible—to accomplish some task. Then the computer takes hold of them in a way that other machines do not.

Computers are undeniably liberating. Children can escape adult-structured chores by burrowing into a computer game that leaves their parents hopelessly baffled. A writer is freed from the finger-numbing tedium of typing draft after draft, instead able to massage sentences and words to refine the piece. Engineers can build and tear down structures repeatedly in an attempt to get something that looks and works right—without waiting for the machine shop to build a prototype.

Computerphiles thus use words like control, mastery, and magic. And they often express joy at their independence from other people's skills. This is what the revolution in so-called desktop publishing is all about: anyone with a computer and a laser printer can churn out pamphlets, newsletters, and other small publishing jobs without turning to professional typesetters and print shops. The result may be an overall lowering of aesthetic standards as millions of typographical novices grapple with fonts, leading, and kerning. But the practitioners of desktop publishing tend to feel the same glee as a 3-year-old walking up the stairs without holding an adult's hand—the “I can do it myself” epiphany is powerful indeed.

Computer users also describe their machines in more rapturous ways, suggesting reveries on sensual experiences such as sex and chemical intoxication. Howard Liptzin, a San Francisco-based graphic designer, says that using graphics software on his computer gives him a “weightless feeling, like my mind has been freed of the constraints of gravity.” Tom Valovic, senior editor of *Telecommunications* magazine, talks of the “pure, fugue-state, mind play involved in connecting with the PC.” Lily Pond, who uses a Macintosh to produce a San Francisco-based literary quarterly called

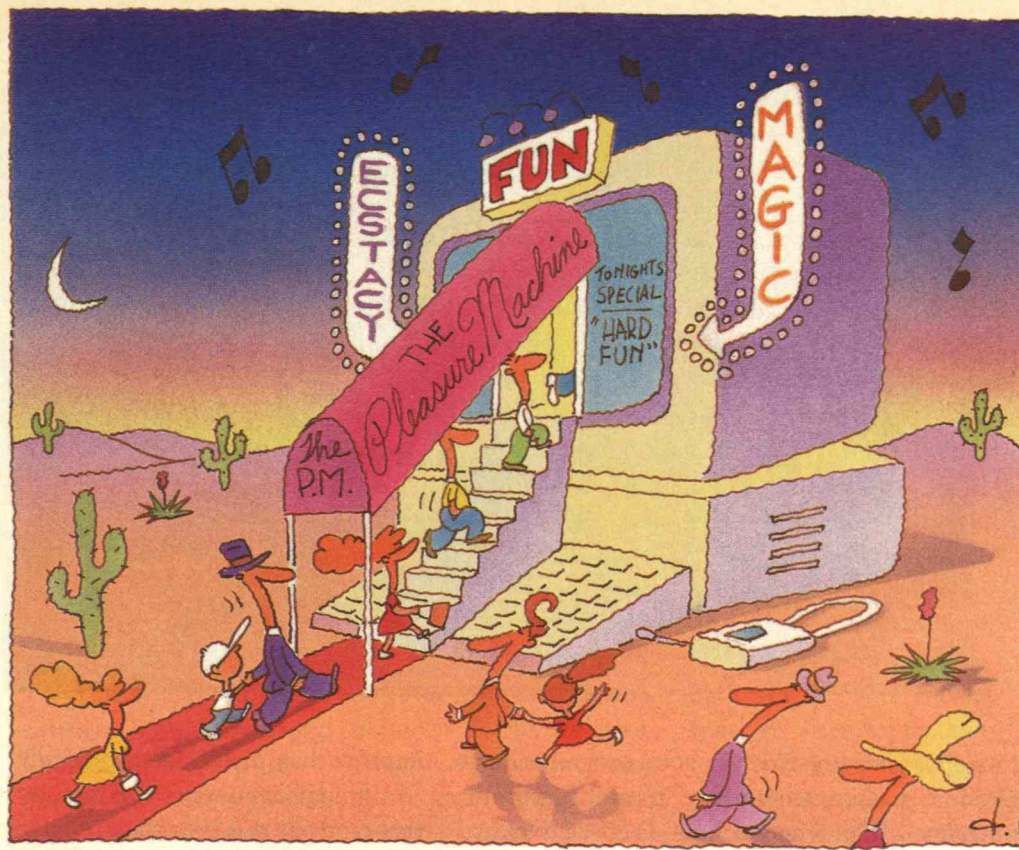
Yellow Silk, says that the thrill is “almost, but not quite, sexual—it's more like growing a foot taller in just a second or two.”

A Magnificent Obsession

A few years ago, when I joined the staff of a new computer magazine, I was astounded by how passionately readers cared about their computers. Each issue of the magazine drew scores of letters to the editor—intensely written little essays arguing the relative merits of various pieces of PC hardware and software. The stack of letters from that magazine's premier issue was about six inches high. I spent a few lunch hours reading through them. The writers referred lyrically to their favorite word processors and spreadsheets, and likewise lashed out bitterly at products that did not square with their standards. These readers exhibited about their computers the kind of emotional, possessive pride usually associated with one's children or alma mater's sports team.

Thus the implications of computing pleasure go beyond mere hedonistic interest. If computing is a pleasurable experience, people will—for better or for worse—spend more of their lives at computers. Staying afloat in the rapidly rising information-rich ocean requires a certain degree of comfort in using information technologies—a comfort that can best be achieved if computing is a pleasurable experience.

But just as parents find their children alternately delightful and infuriating, so do computer users experience much that is far from euphoric with their machines. Indeed, the very notion of computer ecstasy puzzles people who have never felt it. For them, working with a computer raises no more emotion than using a toaster. They don't join user groups, sign on to bulletin boards, or lust after the latest products. They are not seduced by what Provincetown, Mass., poet



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Sarah Randolph calls the “new porn”—thick glossy computer magazines and instant-gratification phone-order catalogs.”

This indifference arises in part from the correct observation that the influence of the computer has not quite fulfilled its promise. If computers are such wonderful information-management machines, then “why do I see so many computers with Post-It notes stuck all over them?” wonders S. Joy Mountford, manager of advanced technology in Apple Computer’s human interface group. Beyond this inadequacy, computers still hold the terrifying power to lose or destroy information. “A computer lets you make more mistakes faster than any other invention in human history, with the possible exceptions of handguns and tequila,” says Mitch Ratcliffe, a staff writer for the Macintosh publication *MacWeek*.

And of course, the power that the computer confers to endlessly revise, to tinker, to edit, is not necessarily all to the good. Corporate managers complain about the new breed of busi-

ness school graduates who are adept at spreadsheet manipulation but who confuse the ability to produce an attractive chart with sound business analysis.

In fact, computers seem to encourage people to obsess over what are, ultimately, secondary concerns. Office workers don’t just dash off handwritten memos anymore, complains Mountford. Instead, she observes, “they spend hours getting the layout just right.” As a result, she says, work progresses not much faster than it ever did.

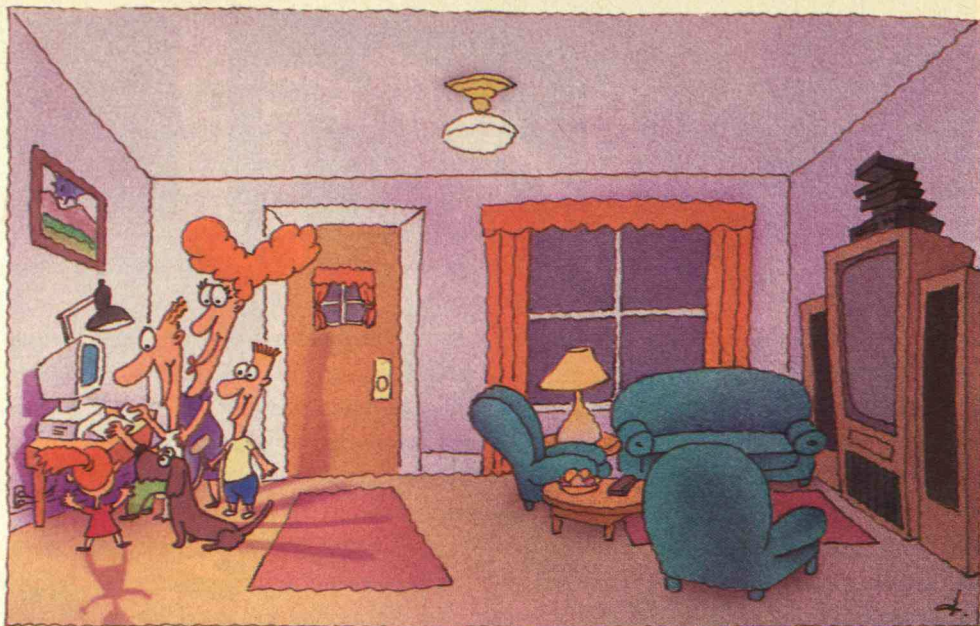
I have been a writer and editor since the late 1970s. Wild editors-in-chief could not drag me away from my Macintosh and plunk me in front of a typewriter, scissors, and tape. But I cannot honestly claim that the ability to massage paragraphs endlessly before ink ever touches paper has made me a better or more productive writer. (Truth be told, I almost missed my deadline on this article—I became absorbed in learning the features of a new version of my word processor.)

Going with the Flow

The essence of computer-using pleasure appears to be the machine’s responsiveness. Computers give instant, unambiguous feedback that is inherently satisfying—and that is lacking in most human encounters. Indeed, the “computer is a little Skinner box, dishing out rewards at regular intervals,” says Robert LaRose, professor of telecommunications at the University of Michigan. Put the program through the right gyrations and you get a beautiful on-screen graphic. Use different keystrokes or movements of the mouse, and a document is perfectly formatted. This constant cycle of positive reinforcement is well known to psychologists as an effective way to condition behavior, LaRose points out.

And, he says, once a person comes to expect satisfaction from a computer, a Pavlovian anticipation can develop. If computer use is, overall, a satisfying experience, then the user will experience little bursts of pleasure from the machine’s many sensual

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cues—its beeps, the whirr of its disk drives, the sound of the keystrokes.

"My computer has become my metronome," explains Arthur Kleiner, a writer based in Oxford, Ohio. "I construct my pauses, my breaks of attention, to match the rhythm with which the computer brings up programs, saves files, dials a network, or stalls while processing a heavy data base."

At its best, computing's rapid and rhythmic give-and-take resembles the "high" people experience from any activity in which their skills are well matched to the challenge of the task at hand. If the challenge exceeds the skill, the person feels anxiety; if the reverse is true, boredom ensues. The optimal match, posits University of Chicago psychologist Mihali Csikszentmihalyi, produces a euphoric involvement that he dubs "flow."

Computer games, in particular, are highly challenging, require skill, and offer rapid feedback. The level of difficulty ratchets upward incrementally, ensuring that the player is always challenged but never overwhelmed. "There can be little doubt," says Csikszentmihalyi, "that the flow experiences they engender explain much of the popularity" of computer games. Even in more serious software, there is

a game-like feel: good programs invite users to explore, to test new commands and menus—in effect, to play.

A common theme that runs through these and other odes to computers is a keen appreciation of the machine's power. To enthusiastic computer users, power is not just a set of numbers signifying microprocessor speed and memory size. Power means leveraging one's mental resources, accomplishing tasks dramatically quicker than without a computer.

The computer's blend of flow, play, and power is especially apparent in children. "We often see kids in school who have never been turned on by anything, and who are not doing well, and then we introduce the computer," says Seymour Papert of MIT's Media Laboratory. "They get very excited, and begin to do work that astounds their teachers—and themselves. The kids are thrilled that they can do something that seems so complicated."

In the most dramatic instances, Papert says that several schoolchildren who have been classified as learning-disabled have surpassed their supposedly "normal" classmates in their ability to construct programs. Often, says Papert, kids who gain confidence through their computer abilities then

improve their performance generally.

A fundamental verity of education is that motivation is everything. Children (or adults, for that matter) will learn when it turns them on. For many kids, computers are a turn-on—and they will learn very rapidly and effectively using the computer as a teaching tool. Using a single program called *PC Globe*, my son has taught himself more about world geography, and about how to read graphs, maps, and charts, than I learned from years of conventional instruction. The secret is that he is willing to try again and again, to plumb the depths of the information contained in this piece of software. He could have used encyclopedias and other traditional materials, but they aren't anywhere near as much fun. "The phrase we hear a lot from the kids we work with," says Mitchell Resnick, a researcher at the MIT Media Lab, "is that computer work is 'hard fun.'"

Computers at their best give kids the opportunity to work in their own style. Even video games offer this versatility, which appeals to children's desire for self-expression and individuality. "Look at a game like *Super Mario Brothers*," says Resnick. "Some kids explore the world the game has created. Others try to pile up points. Others try

Computer-Based Communities

THE era of the island-computer is coming rapidly to a close. Many computer users now have modems for connecting their machines to the telephone network, which promises to amplify computing pleasure greatly. Networking is extending the typical session at a computer beyond the traditional activities of massaging information into useful and attractive forms.

"A computer without a modem is a pretty sorry excuse for a computer," says Reva Basch, a professional database searcher. "I love tracking down arcane facts in on-line indexes, or amassing, in minutes, piles of useful information that would take days to track down in a library, assuming you could find it at all. When a difficult search works out perfectly, I feel

like I've pulled a rabbit out of a hat."

Few people have the opportunity to regularly experience the thrill of tapping enormous information banks; the costs of these on-line services are too high to allow for casual use. To a far larger population, the joy of computer outreach comes from the ability to electronically chat with other people. And that's as it should be, because communication resonates deeply in the human spirit. Thus, computing is coming more and more to mean communication.

Electronic mail is bringing back the lost art of letter writing, but with an important twist: e-mail messages often generate an immediate response from the recipient, and the ensuing exchange is more like a transcribed telephone call

than a written correspondence. It is just this immediacy that many computer users find stimulating; e-mail exchanges provide the informality of telephoning without the hassle of linking up at a particular time.

E-mail is just one part of the broader phenomenon of electronic communities: people can use their computers and modems to connect to any of thousands of local bulletin boards or nation-wide conferencing systems. "There's a random quality to inhabiting that information space that's quite appealing—like going to a coffee house and not knowing who you'll happen to run into," says energy economist David Kline of the National Renewable Energy Laboratory in Golden, Colo.

"Armed with nothing more than a laptop com-

puter with a built-in modem, I can, from anywhere there's a telephone, pursue conversations that help me think about a problem more clearly, watch debates forging new ideas, or drum up additional consulting business," says Tom Portante, an anthropologist and management consultant in Belmont, Mass. By connecting to what he calls this "ethereal intellectual bazaar," Portante gets "a feeling — not infrequently an Olympian one — of being on the moving edge of something, of somehow finding one's place on a rough-and-tumble frontier." It is this thrill of adventure more than any abstract desire to form new kinds of societal relationships that is driving the emergence of computer-based communities. ■

—Herb Brody

to last a long time. That's the secret—lots of different kids like it because they can play it in different ways to suit their individual styles."

Good software is riveting because it can continue to offer new challenges just a notch above the ones just surmounted. This is, after all, what keeps people (young and old) plunking quarters into video games. The game greets success by immediately posing a new challenge, just harder enough to keep the game interesting without becoming unplayable. If only human educators were as consistent in their ability to incrementally ratchet difficulty when teaching kids new skills and ideas.

More generally, says Papert, computers provide constant "challenges to

perfection." A word-processed document stands ready to be instantly edited, a spreadsheet tinkered with, a game played one more time for a higher score. Other activities also can be refined—playing a musical instrument, for instance, or athletic performance—but they require a much larger investment of effort. "It's the low cost of the 'one more go' that makes computers unique," says Papert.

All this helps account for computers' holding power—but what of the intensity of the computing experience? Why do people get so immersed in their interactions with these machines?

"A computer is as close as you can get in this world to magic," says Nathan Myhrvold, vice president for

advanced technology and business development at Microsoft. Computers, he says, "let you manipulate things without physical constraints." Working with a computer, there's little barrier between thought and deed. Software, after all, is essentially crystallized and codified thought. In a program, says Myhrvold, "you just describe something, and it comes true. That doesn't happen with anything but computers. The only limit is the cleverness of the programmer, and cleverness is a virtually boundless resource."

That sense of magic keeps coming up in conversations with computer enthusiasts, especially programmers. "To me, writing a computer program is like playing with electronic Legos,"

says Chris Peters, general manager of the Microsoft business unit that produces *Word*, a popular word processor. Writing a program, he says, is like "building a piece of incredibly complicated machinery, totally unconstrained by physical reality. You don't have to worry about getting the gears to mesh."

The programming community's almost child-like enthusiasm can infect software users. "Software is at its best when it is at its most human, when you can feel the designer trying to imagine you, the user," says poet Sarah Randolph. Macintosh software in particular, she says, is "often full of small presents from the programmers. It's a kind of seduction, or romance."

Beyond User Friendliness

While some computer companies make a point of producing easy-to-use systems, they are not, by and large, consciously pursuing the "joy angle." Makers of hardware and software still stress productivity. Even Apple—arguably the computer company most tuned in to computers' emotional appeal—has concluded that advertisements for its products work best when they address the practical aspects.

Computers have not yet progressed to the commodity status of automobiles, where the public is already sold on the notion that a car is useful. Would-be computer buyers still need to be convinced that the machine will save them time, make them money, or make their lives easier. They'll accept fun as a fringe benefit.

Still, some major computer companies are striving to make their products more enjoyable. Microsoft, the largest producer of personal computer software, has established a "usability lab." Software developers give test users new programs and assign them a task. The developers then watch through one-way mirrors. The goal,

says Peters, is to produce a program that can be manipulated largely without manuals.

It is through such testing that Microsoft—and other software companies—have discovered some basic principles of user-friendliness. For example, says Peters, "it is very important that the screen always show something happening. If there has to be a 30-second delay for the computer to recalculate a modified spreadsheet, there ought to be some visual indication—such as the spinning watch hand familiar to Macintosh users—that work is in process and that the computer has not frozen up."

Apple has taken this idea even further by observing workers not just when they are at their computers. Mountford's group takes a video camera "on the road," where it can watch people do their job all day long. And she has found, for example, that "a lot of people spend 80 percent of their time just looking for things." To reduce frustration, then, computers should make it easy for people to know where things are. In a good user interface, Mountford says, it's always obvious where users are in the program, where they can get to next, and where they have come from.

There are other ways that software can cultivate what makes computer use enjoyable. One way is for a program to sense what the user is doing and then suggest a shortcut—an "over-the-shoulder interface."

But even those who get great satisfaction from working with computers can see that the technology has a long way to go. In a sense, today's most advanced computers are only whetting our appetites for what might follow—machines that reliably respond to human speech, for example, and software that is far more tolerant of human variability. Even the supposedly "intuitive" Macintosh computers really aren't—"double-clicking" a mouse button has no real equivalent outside the computing domain.

There is a burden, then, on the computer industry. If computers remain merely useful appliances, their potential impact on society will barely be realized—even though the machines will continue to infiltrate the workplace and, to a lesser extent, the home. An essentially captive audience will put up with arbitrary commands, irrational procedures, and ugly screens just to get its work done.

But the companies that make software, in particular, dare not take for granted the geyser of enthusiasm they have tapped. Already, a rift is growing between the computer cognoscenti and those who muddle through, relying, like Blanche DuBois in *A Streetcar Named Desire*, on the kindness of strangers. Computer developers should target the silent majority. They should be paying close attention to what annoys people about today's computers and taking appropriate action.

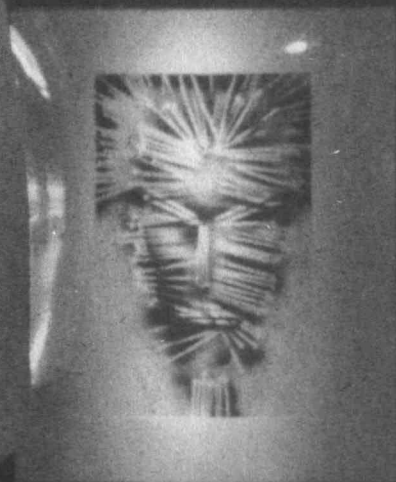
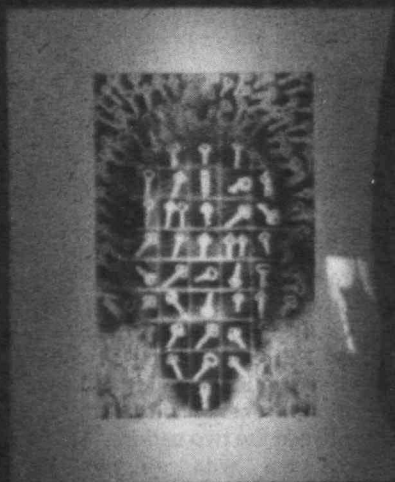
It is an axiom of the computer business that raw hardware power—memory size, processor speed—doubles roughly every two and a half years. It is largely up to the software developers to exploit this appreciating asset. They can continue to complicate their products—adding feature after feature that intensify their appeal to the dedicated few—the equivalent of car manufacturers upping engine horsepower every year while ignoring refinements in the dashboard. Or they can apply this escalating computational power to improving the computer's own "dashboard"—the user interface. That means making computers not just easy to use but a *pleasure* to use.

And that's a much bigger challenge than mere user friendliness. Ecstasy, after all, is a short-lived phenomenon: excitement abates, the novel becomes mundane. But with computing, more so than with any other technology, we are building mirrors of the human brain. The potential for computer ecstasy—like the potential for human creativity—is essentially unbounded.

Which ought to please my sons. ■

MIT

APRIL 1992



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COVER

The figure, "Diviner," is a powerful element in the MIT Compton Gallery exhibit of the work of Maine-based artist Valerie Maynard. The exhibit, entitled "No Apartheid Anywhere," confronts the anguish engendered by all forms of oppression—wherever they occur—and has special meaning for MIT students who participated in a sculpture class in connection with Maynard's recent campus residency. In fact, Maynard included a collaboratively produced student work in her exhibit.

Photo by Barry Hetherington.



Corporation Loses Three Life Members

The Institute lost three long-time members of the Corporation this past fall: Robert Sprague, SM '23, Yaichi Ayukawa, '52, and Frank R. Milliken, '34.



Sprague



Ayukawa



Milliken

Sprague, 91, a life member emeritus of the Corporation, died September 27 at his home in Williamstown, Mass. A U.S. Naval Academy graduate who received a master's degree in naval architecture from MIT, Sprague invented radio tone control while serving in the Navy. In 1926 he founded what became Sprague Electric Co. and served as its president, then chair and CEO before retiring in 1971.

Sprague also served as chair of the MITRE Corp. and president of the Massachusetts Science and Technology Foundation and the Federal Reserve Bank of Boston. He was elected to the Corporation in 1953 and became a life member in 1955.

"With his passing, the nation has lost a talented leader of industry and a devoted public servant; MIT has lost a loyal alumnus, a generous benefactor, and a distinguished trustee," said Paul Gray, '54, Corporation chair.

Ayukawa, 68, earned master's and doctoral degrees in food technology and industrial management from MIT in 1955 and 1957. After holding a number of research managerial positions with Japanese firms and obtaining numerous

international patents, Ayukawa became the founding president of Techno-Venture Company, Ltd. He died November 30 in Tokyo.

While studying at MIT, Ayukawa became close friends with his advisor, Professor Samuel Goldblith, '40. When Goldblith was named director of the Institute's Industrial Liaison Program, Ayukawa solicited critical support for the

program from Japanese industry. "Dr. Ayukawa had the unshakable conviction that the future destinies of Japan and the United States were inextricably and appropriately linked, and he devoted his considerable energy to building effective ties between the two nations," said Gray.

Ayukawa was elected to the Corporation in 1977 and to life membership in 1987. He was awarded a Bronze Beaver in 1980. Said Gray, "His devotion to MIT and his influence in his own country were of great benefit to this institution, and their effects will be felt for many years to come."

Milliken, 77, died at his new home in Tucson, Ariz. on December 4. After receiving a bachelor's degree in mining engineering from MIT, he launched a career in metallurgy and materials that eventually led to his serving as president, CEO, and finally chair of Kennecott Copper Corp. He retired in 1979.

Milliken compiled an extensive record of committee service over 25 years with the MIT Corporation, serving at various times on all standing committees. In addition, he was a member of visiting committees for the departments of chemistry, geology, metallurgy, and

others. He received the Corporate Leadership Award in 1976 and was named a life member emeritus in 1986.

Calling him "a devoted and generous alumnus and a trustee of extraordinary dedication," Gray said that Milliken "was an important part of the MIT leadership organization and was a valued counselor to its presidents and chairmen." □

Technology Day 1992: Spotlight on American Business

This year's Technology Day program, *Winds of Change: Achieving Global Business Excellence for America in the 21st Century*, will give alumni/ae a chance to hear what the experts think about the state of American business and what they offer as solutions to U.S. companies' most pressing problems. Especially timely during this election year, the program promises to be stimulating and provocative.

Technology Day takes place June 5th, the Friday during Reunion Week. It has traditionally focused on a single department or school, but this year's meeting is different. The Technology Day planning committee decided that an interdisciplinary approach would allow a wide-ranging analysis of the difficulties facing American businesses and offer topics of interest to the broadest possible group of alumni/ae. As a result, T-Day '92 will feature authorities drawn from humanities, social science, management, and engineering.

The day is divided into two sessions. In the morning, a panel will identify and discuss the problems facing businesses today. During this session, specific business issues will be discussed in order of increasing complexity—starting with the individual, then moving on to the business organization, its institutional context, interactions between business and education, and public policy. Professor of Political Science Suzanne Berger will lead the morning program.

In the afternoon, alumni/ae are invited to select from a variety of mini-meetings,

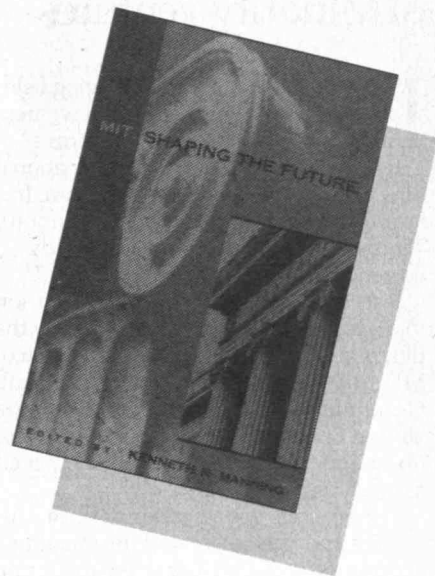
which will examine the morning's topics in further detail and offer many opportunities for audience participation. Topics to be discussed include: "The United States in the New World Order," led by Lester Thurow, dean of the Sloan School; "Can the East Learn from the West," led by Philip Khoury, dean of the School of Humanities and Social Science; and "Building the Next Century's Organizations," led by Kenan Sahin, '63, president of Kenan Systems, a Cambridge software developer. Sessions on education, manufacturing, and the relationship between humans and machines in the workplace are also on the docket. Following the afternoon session, the MIT deans will host a special reception where guests can chat with Technology Day speakers and panelists.

Other special activities, all providing reunion classes with an opportunity to make new friends and mingle with old ones, have been planned as part of the Reunion Week celebration. For example, on Thursday evening, alumni/ae and their guests are invited to Symphony Hall for the traditional Tech Night at the Pops, a performance by the Boston Pops Orchestra exclusively for MIT. On Saturday, the annual Alumni/ae Games and Techsas Barbecue will be held.

Alumni/ae living in New England and those belonging to 1992 reunion classes will automatically receive preregistration information in the mail. Alumni/ae who don't fall into either of these groups can call the Alumni/ae Office at (617)253-8233 for more information.—Judy Norkin □

Inaugural Book Looks Ahead

One lesson Charles Vest surely learned about the Institute this past year as he assumed its presidency is that this is a community of diverse, provocative voices. Ask its members to share their thoughts on as broad a topic as the school's future and, as the committee planning Vest's inauguration discovered, they will respond willingly and with wide-ranging opinions.



And so was born *MIT: Shaping the Future*, a collection of 16 essays by MIT faculty and staff on issues this community will face in the next century. Edited by Kenneth Manning, Meloy Professor of Rhetoric, the volume was first presented to Vest at an inaugural event this past fall.

Essayists range from Career Services Director Robert Weatherall and Professor of Writing Rosalind Williams writing on general topics such as whether technology does shape the future to more personal pieces from Alan Oppenheim, '59, electrical engineering professor, and Cynthia Wolff, professor of literature. Among other topics: the proper balance between national and international interests in education and research, computational linguistic breakthroughs, the Institute's role in addressing societal issues such as pollution and productivity, and international education.

Manning cautions that the while the volume offers a wide sampling of issues and opinions, it by no means touches on "the full spectrum of concerns relevant to the MIT experience."

Softcover copies of *MIT: Shaping the Future* cost \$9.95. To order, call the MIT Press, (617) 253-5643. □



ALUM NEWS

Hazards and Rewards of Minority Ventures

Is entrepreneurship a level playing field for blacks and whites, men and women, native- and foreign-born Americans?

In theory, said Paul E. Johnson, national director of the MIT Enterprise Forum, Inc. (a project of the Alumni/ae Association), "entrepreneurship knows no bounds . . . no gender, no ethnic or racial barriers."

But theory is far from reality, as Johnson told a half-day conference arranged by the Enterprise Forum and the Black Alumni of MIT (BAMIT) in Cambridge late last fall. He admitted that entrepreneurship in the United States is largely limited to white males and its benefits have mostly flowed to mainstream America.

The reasons are a matter of both economics and prejudice, said the meeting's economist-activist keynoter, Julianne Malveaux, PhD '80, visiting professor at the University of California at Berkeley:

■ Minority-owned businesses, from which must come most of the capital for minority entrepreneurship, are themselves a tiny minority in the United States; they make only 0.3 percent of all sales, said Malveaux.

■ Entrepreneurs typically finance their start-ups through loans on their homes,

but banks are gun-shy of loans secured by real estate in black neighborhoods. "Bankers implicitly assume that we cannot do entrepreneurship," Malveaux charged.

■ In today's social and business climate, other investors interested in minority businesses are also few and far between.

■ Many of the special programs of the 1970s and 1980s to provide minority opportunities and to stimulate business development—affirmative action programs, tax advantages, and investment incentives—are now under attack, said Malveaux.

■ A start-up company locating in a black community will pay exorbitantly for insurance, and would-be investors, customers, even salespeople may hesitate to visit the site.

In addition to the special hazards Malveaux cited, minority entrepreneurs face the same challenges as other start-ups. Here's a sampling of the advice from other experts at the workshop:

■ Every manager needs to communicate effectively with his or her employees, said Charlene Antonellis, president of Antonellis and Associates, Boston, and that's especially true in a start-up company. Be sure your workers are aware of all their benefits. Report on how the company is doing and share your visions for it. "If you're not going to communicate with your employ-

ees, then you're not going to retain them," Antonellis said.

■ Just like majority firms, minority-owned companies must have and fulfill affirmative action plans. "A key thing for a minority-owned enterprise is not to engage in reverse discrimination," said Antonellis. And watch out for harassment, which can just as well be racial as sexual, she said.

■ When you are preparing to leave your current job to start out on your own, do none of the planning on your employer's time. And when you leave, take nothing with you—not even your Rolodex, said Harry T. Daniels of Hale & Dorr, Boston. "Litigation can kill a start-up faster than anything else," he warned.

■ Include personal financial targets in your business plan and stick with them. For example, don't project in your plan a lower salary for yourself than you can live with. "If you can't tolerate the humble existence your business plan requires, stop before you start," said consultant Sharon A. Wulf.

Despite the hazards, the spirit of entrepreneurship is very much alive among minorities, according to Malveaux. And the rewards may be very great.

Five years ago, Malveaux recalled, *Black Enterprise* magazine found that 60 percent of the country's black managers had the goal of going into business for themselves. And they're doing it. According to her figures, the number of black-owned businesses grew by 7 percent between 1982 and 1987, compared with 5 percent for all businesses.

But black entrepreneurs, more than other businesspeople, must think in terms of "benevolent capitalism"—starting a company not only for personal profit but because it can benefit the minority community. Consequently, a successful minority entrepreneur has to be prepared to face a tough question: What proportion of the profits should be reinvested for the future growth of the company and what can be invested in the community's urgent needs? The rewards awaiting entrepreneurs are therefore political as well as financial: they can help to increase the economic opportunities for U.S. minorities in today's recession. —John I. Mattill □



The BAMIT/Enterprise Forum workshop on minority entrepreneurship was a chance for (l to r) Darryl Hughes, Bridget Ware, MCP '89, and Deanne Chevannes to gather information and ideas.

Concourse at 20: Still Crazy After All These Years

During my freshman year I spent uncounted night hours in a bare cluster of rooms in Building 20, doing problem sets with my classmates in the Concourse Program. We watched dawn come through the lounge windows more than once.

Mornings, all of the 60 Concourse freshmen reassembled for lectures in the freshman core subjects. In 1981, lectures meant Professor of Biology and Concourse Director Jerome Y. Lettvin telling us preposterous stories to inoculate us against passively accepting data from others, followed by Professor of Materials Science and Engineering Bob Rose, '58, telling us only slightly less amazing stories drawn from real-world consulting (Rose has been director of Concourse since Lettvin's retirement a few years ago), or Professor of Mathematics Ross Finney, a master of the chalk-on-blackboard medium, drawing intricate graphs of three-dimensional calculus problems.

Alumni/ae who participated in the very first session of the "Concourse Experiment" in 1971 recall a vastly different program, so freewheeling and interdisciplinary that it virtually had no curriculum. They remember meeting in the Given Room, a seminar room complete with fireplace, couches, full kitchen, and fifth-floor windows convenient for impromptu gravitational experiments. They remember a ratio of seven faculty (including three nonscientists) to 14 students, unequalled in MIT history, and a surrounding environment of strikes, sit-ins, and optional finals.

Five members of the charter group had ample opportunity to reminisce during the Concourse 20th anniversary celebration, a fall weekend that attracted more than 100 of the 1,200 alumni/ae and professors who have participated in the program.

Concourse was originated by a group of faculty, including Professor of Literature Travis Merritt (now associate dean for student affairs) and Judah Schwartz (Concourse's first physics teacher and now professor of engineering science and education) at the height of the movement toward student-faculty democracy in educational institutions. The hypothesis of the Concourse Experiment, as it was then called, was that an interdisciplinary team of professors could produce a curriculum that was more than a sum of its parts.

DIANA BEN-AARON is a freelance writer and research analyst at The Research Board in New York City.

For the entire first year, students and faculty engaged in a wide-ranging dialogue covering everything from Milton to celestial mechanics to population to perception, with little reference to General Institute Requirements. But freedom ultimately proved frightening: at the end of the year, students panicked because they weren't making progress on graduation requirements. So the program was redesigned to cover basic subjects in calculus, physics, and chemistry as well as two semesters of humanities and an interdisciplinary lecture-seminar. Around the same time, the two-year scope was compressed to one year, for freshmen and transfer students only. But the general character of the program—an extended conversation among a closed but diverse cast of characters—did not change. "Watching Jerry Lettvin argue with someone about Kant for an hour is not an experience you're going to get in the regular curriculum," remarked Brent Cochran, '78, now an MIT biology professor.

As Lettvin says, Concourse was never meant to be "an alternative to the regular curriculum or to MIT, but an alternative place of learning," sized for a group instead of a legion. The atmosphere of mutual support makes it particularly attractive to students who do not feel confident about their high school preparation. Scratch a panel of

Concourse students and you'll hear: "I went to a rural school with 99 people in my graduating class." . . . "My school didn't have physics or calculus." . . . "A teacher convinced me girls couldn't do math." Yet whatever their experience before Concourse, studies prove students' marks after Concourse are, on average, equivalent to those of the student body as a whole, says Concourse Administrator Cheryl Butters.

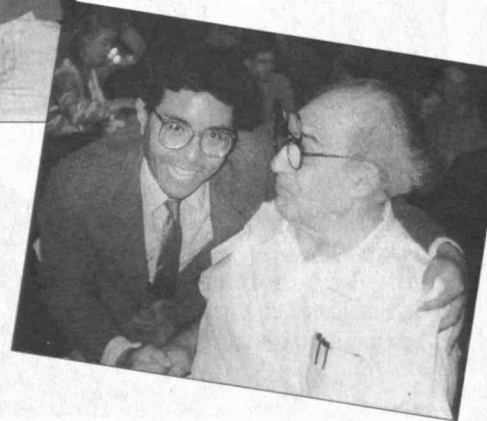
The themes of interdepartmental faculty cooperation and engaging the freshmen in their own education may be the only constant since the initial idyll of 1971. Explains Lettvin, "Concourse people learn by mutually enjoying themselves. It was a pleasure to see students being amiable and cooperative. The faculty could all talk to each other and pinch hit for each other. They could cooperate because they were outside the departments, not competing against each other for tenure." The experience can be valuable in later life as well: "Engineers who can't collaborate often find their careers in industry blocked, so learning to work in groups is important," says John Hainsworth, '81.

"One of the original predictions about Concourse was that when these seven crazy, ambitious young cats run out of energy, the program will meet its demise, because there will be no one to take their place," reflects Travis Merritt.

Those who thought so were wrong: faculty has turned over several times. This renewal helps the program maintain its experimental flavor, and the consensus among alumni/ae in September was that the results are positive and the experiment should continue. Says Judah Schwartz: "Concourse is one of the ways the Institute experiments with education and examines its own life." □



Among the celebrants at the Concourse anniversary were (above, left to right facing camera) long-time Concourse Administrator Cheryl Butters, Robert Bernstein, '76, and Lillian Shawn Gramates, '85. Peter Mui, '83 (right, in suit), was one of many Concourse alumni/ae who relished the chance to renew ties with the founding Director Jerry Lettvin.





LK

Academia's Foreign Policy

BY RICHARD BRANDT

*As U.S. universities
come under attack
for their open door
policy regarding
foreign scholars
and industrial
collaborators, MIT
is taking the lead
in examining and
articulating the
academic position.*

In the summer of 1989, then-President of MIT Paul Gray, '54, went to Washington to testify before Representative Ted Weiss' Subcommittee on Human Resources and Intergovernmental Relations of the House Committee on Government Operations. The topic was technology transfer to industry, and Gray expected the worst controversy to be over potential conflicts of interest for academics collaborating with outside researchers. But he found himself up against a much deeper issue. By admitting foreign companies to the Industrial Liaison Program, asked the committee members, isn't MIT contributing to the decline of U.S. competitiveness?

That grilling was not the last time such an issue was raised. The lingering recession, growing trade imbalance, and the slipping technological superiority of the United States are compounding anxiety over the role that universities—and MIT in particular—may play in helping foreign competitors.

Congressman Weiss has expressed concern about the Institute's relationships with foreign companies. The National Academy of Sciences (NAS) has debated the wisdom of universities accepting foreign research contracts. An article in the *New York Times* questioned Japanese funding at the MIT Media Lab. Some observers worry over the number of foreign students studying here. And such questions are not likely to go away. "This is going to be an extremely emotional and important topic in the coming years," predicts MIT President Charles Vest.

In 1990, Provost John Deutch, '61, commissioned a Faculty Study Group chaired by Eugene Skolnikoff, '49, to

review MIT's "foreign policy." The report, called "The International Relationships of MIT in a Technologically Competitive World," was completed last May and presented to the faculty in October. It is now being circulated to industrial, political, and academic leaders nationwide for comment.

Many observers, including Deutch and Vest, believe that the report will not only play a central role in MIT's future policy but will help represent academia's point of view as the national debate continues. On January 17, for example, the NAS distributed the report to participants in a forum discussing the issue of Japanese access to U.S. research. "There has been no other serious look at this issue at any

other university," says Deutch. "This begins the most comprehensive discussion of the issue that I know of."

A fundamental tenet of the Institute's stated mission has always been to enhance technology that benefits society. Since about three-quarters of its research budget comes from Washington, how much of that emphasis should be on U.S. society? That question was never raised when the United States was secure in its position as the world's undisputed leader in science, technology, and industry. "This country's public policy has always been to simply create the knowledge and let it trickle down to the user," notes Lewis Branscomb, who heads the Science, Technology, and Public Policy Program at Harvard's JFK School of Government.

These days, of course, some of that knowledge trickles overseas. And, as politicians and industry leaders have discovered, foreign companies—particularly in Japan—have proven adept at turning technology into business advantage. Thomas J. Murrin, former deputy secretary of commerce and now dean of the business school at Duquesne University, compares it to the days when American companies casually sold their technology to Japanese competitors. "American companies used to think their technology exchange agreements were very much in their own self-interest," he says. "What we didn't anticipate was what incredible students we were dealing with."

But for universities, the issue may be more complicated. Skolnikoff's report emphasizes the fact that universities have always thrived on an open exchange of information. And with growing scientific and technological competence overseas, foreign re-



searchers are no longer only students of U.S. technology, but teachers as well. "It's of growing importance to learn what's going on in the rest of the world," says Skolnikoff. "We can only learn by being open to the rest of the world."

Still, MIT has its obligations to the government that provides its primary means of support. Skolnikoff's report recommends that if conflicts between its national and international roles arise, the administration "should give primary weight to the general responsibility to the nation." Among the report's other recommendations were ways to increase the participation of American firms in MIT research projects and to place limits on foreign students in some graduate programs. (See box, page MIT 9.)

The report concludes that MIT's national obligation is best fulfilled by simply maintaining its position as a top research university. That means continuing such practices as accepting a high percentage of foreign graduate students when there are few qualified American applicants; accepting mon-

ey for endowments and chairs from overseas sources, even if they include such provisions as sending a visitor to a laboratory; and continuing to invite long-term researchers from overseas. Rather than mandating specific rules, the report recommends general guidelines, such as accepting only foreign researchers who agree to publish openly and who can contribute to the intellectual life of the Institute.

Though many Institute faculty and administrators consider the report well-reasoned, Vest says he will not determine MIT policy until he has collected more comments from outside. The view from the capital, however, is still skeptical. Observers say that political leaders are not likely to accept the argument that MIT's primary obligation is to gain knowledge, not worry over who might exploit it—or to "be more concerned with keeping the bucket full than with plugging little leaks," as Vest puts it. "In Washington, that argument in its pure form doesn't really wash," says Mitchel Wallerstein, PhD '78, deputy executive officer of the National Research

Council. "There's a sense here that the jewels in the crown—such as MIT, Stanford, and Johns Hopkins—ought not to hold themselves apart from the national debate."

Washington pundits are concerned that when American professors and foreign researchers collaborate, knowledge transfer is too often a one-way street. "Who really gets more?" asks Erich Bloch, former director of the National Science Foundation and now a distinguished fellow at the Council on Competitiveness, a private think tank. "You'd have to convince me the university gets more."

Bloch's concern is that foreign governments such as Japan's fund very little basic research that can be transferred back to the United States. Instead, the Japanese rely on American-funded research at universities and national institutes. "I'm after a quid pro quo," he says.

Another issue is the growing number of students coming to the United States to study. MIT already limits undergraduate enrollment from overseas, but decisions on graduate admis-

sions are made by individual departments. Currently, about 33 percent of MIT's graduate students are from other countries, up from 26 percent a decade ago but less than the 50 percent common at many engineering schools. The level of foreign participation in each department is a function of the interest from American candidates; only 25 percent of the graduate students in electrical engineering and computer science are foreign, for example, compared to 50 percent of the nuclear engineering students and 56 percent of the civil engineering students. The report concludes that foreign graduate enrollment ought to be restricted only in those fields in which there are adequate numbers of qualified American applicants.

Still, there are no specific rules for determining appropriate limits in each department. Even Vest thinks 33 percent "may be a little on the high side" of acceptability. And some still question whether tuition should be raised for international students. Because tuition covers only part of the costs of an MIT education, federal funding makes up a substantial part of the difference. "In this day and age, is it appropriate that we subsidize foreign students?" wonders Robert Muh, '59, president of the consulting firm Financial Services International in San Francisco and president-elect of the MIT Alumni/ae Association. Skolnikoff responds that raising tuition would make an insignificant difference in MIT's budget and "send a message abroad that we are only interested in wealthy students." It is also pertinent to note that some 60 percent of foreign students receiving doctorates at U.S. universities elect to remain in the United States.

Although Skolnikoff's report recommended guidelines on accepting students or research money, it left the final judgment up to the individual faculty members. "This can't be done by edict," he insists. "The strength of a university is based on the strength of its faculty. It's decentralized for a reason. When you tell them what to do in terms of their creative research, you destroy [that strength]."

But American universities can no longer rely on academic freedom arguments alone when it comes to the use of public funds. NRC's Wallerstein notes that "universities have a PR problem. In the minds of the public and the typical congressman, we're pumping money into research, and other countries are mining it."

In any case, many corporate executives and members of the MIT Corporation who have seen the report applaud its success in helping put the issues into perspective. Some believe that universities have been unfairly blamed for American corporations' own shortsightedness. "There's been a certain amount of bashing of Japan by companies that want to sit back and do things as they have for 70 years," says Charles W. Johnson, '55, Corporation member and chairman

of semiconductor equipment maker IMSL Inc. in Houston. "Some U.S. companies have been negligent in getting involved with universities. I don't think cutting foreigners off from the Industrial Liaison Program or [endowing] professorships would change that."

Jerry Cogan, SM '58, president of Millikin Research Corp., agrees. "There's no question there's an economic war going on, and we're losing." He blames corporate practices, not university policies. "Let's deal head-on with this matter, rather than dealing with it in such secondary ways." □

RICHARD BRANDT is a reporter with Business Week magazine, currently on leave for a Knight Science Journalism Fellowship at MIT.

A Summary of the Skolnikoff Report

The Faculty Study Group report, "The International Relationships of MIT in a Technologically Competitive World," recognizes MIT's obligations as "a national institution rooted in American culture and traditions and an integral part of the nation's education and research system." But it also concludes that MIT's responsibility to this country is served "first and foremost by maintenance of its position as a premier institution in education and research in science and technology."

Some of the report's recommendations:

- MIT should continue to limit the number of undergraduates from overseas to about 8 percent of the total.
- It should also limit the proportion of foreign students in graduate programs when there is a large pool of qualified American applicants.
- American firms should be given an early chance to participate in promising research projects, sometimes creating consortia that exclude foreign firms.
- Foreign companies should pay higher fees than U.S. companies when sending researchers or joining the Industrial Liaison

Program (ILP). The administration also should consider means to attract domestic corporate visitors, such as by waiving fees.

■ MIT administration should issue a statement of policy requiring long-term visitors to exchange knowledge openly—but should rely on the judgment of the faculty or laboratory being visited.

■ The Office of the Provost should designate staff members to address international issues with faculty input.

■ MIT should set up a clear process to evaluate individual controversial circumstances, such as accepting foreign students or visitors from particular countries into nuclear engineering programs.

■ The administration should consider expanding the role of the ILP's Tokyo office to help MIT and ILP members learn about the science and technology community in Japan. It should also consider a similar office in Europe.

■ MIT should create a program to inform the Executive Branch, Congress, industry, and the public of MIT's perspective on these issues, and should speak on behalf of American universities and science and technology in general.—R.B. □

Project Athena, the Authorized Biography

REVIEWED BY
ROBERT M. METCALFE, '68

In his book, *MIT Project Athena, A Model for Distributed Campus Computing*, George Champine summarizes 2,800 pages of reports about how MIT, IBM, and DEC spent \$100 million over eight years (1983–91) to build an educational computing environment at MIT. The project was named for the Greek goddess of wisdom, but after reading Champine's book, I am thinking more of a goddess with three heads, tons of money, a tragic disdain for the work of others, and a brood of precocious children.

While it's not a book for cozy evenings by the fire, mulled wine in hand, it is an essential document for those of us creating comparable systems on other campuses or taking Athena's next steps under whatever name.

The book's 11 chapters cover the initial vision for Athena, a blow-by-blow account of the transition from vision to reality, Athena's use as an instructional system, battles with the MIT faculty, the model of distributed computing, the development of system tools and multimedia workstations, the move into student housing, and project finances and organization. The book is a thorough post-mortem—or should I say post-partum?

The problem with Champine's book is, of course, the classic problem of authorized biographies. The author is a senior scientist at DEC and served as associate director of DEC's on-site Athena project team for 1986–91. His book was published by the Digital Press. These facts both give the book its authority and limit its deep-digging objectivity.

In reading the parts of the book that purport to be critical, I was reminded of the answers that I give to interviewers asking about my few weaknesses: I work too hard, I stick with projects too long, and I offend people by being too honest. Champine's book is an important contribution to the discussion, but now I would like to see a sequel by someone with a bit of journalistic skepticism—technology's

ROBERT M. METCALFE, '68, an early financial supporter of Project Athena, invented the computer networking system Ethernet and founded 3Com Corp. to commercialize it. For the 1991-92 academic year, he is a visiting fellow in the Computer Laboratory at the University of Cambridge, England.



Kitty Kelly, perhaps—to round out the picture by dredging up the dirt on Athena.

Champine presents some impressive numbers: Athena took eight years, cost \$100 million, and brought MIT's campus computing power from 20 to 2,000 millions of instructions per second. Athena now has 1,300 workstations and 100 network servers connected by 41 Ethernets (and some other networks of much less importance).

There are 15,000 Athena user accounts of which, Champine reports, 10,000 are active. Fine, but I would like to know exactly how active Athena's 10,000 active users are—not very—and why another 5,000 are not using Athena at all.

I'd also like to know why Athena took so long to become fully operational. And why were Athena planners surprised that the availability of electronic mail in real time had such an enormous impact on students and staff? I recall this lesson coming out of the Arpanet in the 1970s.

Champine reports that Athena taught MIT students and faculty "that networking has significant benefits." This was

news? Outside MIT there are already in operation a million such local-area networks. This makes me wonder whether Athena, which was supposed to move MIT into the vanguard of undergraduate computing, has just barely kept MIT up with the times.

When Champine gets to the subject of PCs, he approaches what I think is the burning question about Project Athena. Both with and without the considerable benefits of hindsight, we should be asking whether Athena should have stuck with its original plans, at least as the faculty understood them, and brought into MIT a commercially available system of networked PCs—a one-vendor, turnkey system that could have been up and running within a couple of years.

Admittedly, if Athena had waited for commercial PCs and workstations that met its specifications, then it is less likely that MIT would have developed its famous X Window System for managing workstation displays, or the Kerberos authentication service for maintaining network security, or the Hesiod name service for helping users find resources in a huge network, or the Zephyr notification service for keeping network users in touch, or the Muse development system for multimedia instructional software, or other of Athena's many technical gems.

Athena is to be credited for its technical gems, to be sure, but I would like to see a more serious analysis of whether the technical advances were worth the tremendous investment. Or is Athena the latest and most expensive example of MIT's well-known aversion to anything not-invented-here?

Having made my point, that we need a more critical appraisal of Athena, I hereby cast my vote for Athena's most enduring contributions: the people who built it. This cadre of about 50 people, mostly students, who formed the system-development and release-engineering groups will prove whether Athena was worth it. Who are these folks and what are they doing now with what they learned? Champine mentions them, but with not nearly enough enthusiasm or detail. I'd like to see their résumés, updated every five years, so we can monitor their contributions. After all, Athena just invested \$2 million in each of them. □



CLASS NOTES

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In the January notes I reported the passing of **John Holton**. Too late for the February/March issue I learned from John's son-in-law that John's widow, Sarah Pierpont Holton, died a mere five weeks later. A memorial service was conducted for Sally in the Williamsburg, Mass., Congregational Church where John and Sally were married some 72 years ago by Sally's father, Rev. John Pierpont, and where the memorial service had been conducted for John.

Sally, like John, had been active in MIT and community affairs, having served as the president of the women's auxiliary of the Salvation Army in Syracuse the two and a half decades John served that Salvation Army. Among her other commitments were life member of the board of managers of the Elmcrest Children's Center, life member of the auxiliary of Community-General Hospital, and member of their churches.

George Hobart Stebbins died in Seattle September 26—just one day before his 97th birthday. Born in Fall River, Mass., he grew up in Quincy, and graduated from MIT in naval architecture. Following World War I, he managed two of the Bethlehem Steel shipyards in the Boston area and later owned the Boston Drydock Co. until he moved to Seattle.

After World War II, he bought into Seattle's Lake Union Drydock of which he later became president and where he continued to work until he was 92. His son, George Jr., is currently the yard's vice-president. Hobart (as many will remember him) was a long-time member of several organizations including the Rotary Club, the Seattle Yacht Club, and the Society of Naval Architects and Marine Engineers. His wife of 73 years predeceased him by three months.—**Don Severance**, acting secretary, 39 Hampshire Rd., Wellesley, MA 02181

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Please send news for this column to: **Max Selzer**, secretary, 865 Central Ave., Needham, MA 02192

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Good news prevails for our class. We took advantage of it and sent a holiday card to each of the 24 living members. While talking to **Don Way** I learned that he was recovering from some recent surgery. He is recovering nicely at home now.

I got a card from **Francis Weiskittel**. He had an accident on the stairs in his home in Baltimore; his knee was sprained and he was confined to rest for 11 days. He is now walking, driving, and in good shape again. A recent letter from **George Michelson** tells of surgery on both his eyes. He goes to his office daily and feels in good shape.

A letter from John A. Maynard in Florida advises that his son, **Warren A. Maynard**, would like to receive a copy of our "25 year after" book so he can read about some of his father's classmates. I sent him a copy.

Take care and keep up our class record.—**W.O. Langille**, secretary, P.O. Box 144, Gladstone, NJ 07934

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70th Reunion

Please send news for this column to: **Harold Bugbee**, secretary, 313 Country Club Heights, Woburn, MA 01801

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Christmas 1991 has come and just gone as these notes are written. I had cards from **Claudia (Mrs. Josiah) Crosby**, **Helga (Mrs. James S.) Parsons**, **Emma (Mrs. Leon) Lloyd**, **Celia (Mrs. Frank) Huggins**, **Betty (Mrs. Norman) Patton**, **Helen (Mrs. Raymond) St. Laurent**, and **Dorothy (Mrs. Joseph) Wenick**.

Claudia writes she is spending Christmas in Alabama. **Helga** works on getting out a newspaper for her condo. She spent Christmas in North Carolina with her daughter and family. **Emma Lloyd** fell in February 1991 and fractured her upper arm in two places and took no distant trips. She had an eye implant in October. **Ceil Huggins** is her usual busy self—gardening and traveling around the state. **Betty Patton** writes she is only 78, but intends to make 100. She is doing volunteer work at an adult day care center; handicapped, however, when she fell in May and broke her right arm. **Helen St. Laurent** spent four months in Center Lovell, Me., this past summer.

Samuel E. Lunden wrote in November to say that he "made reservations to attend our 70th anniversary but found it necessary to cancel for health reasons. . . . I want to express appreciation for all the work done by the 21 officers over the years since 1921; particularly the expert services of President **Cac Clarke**."

I phoned **Cac Clarke** and learned that **Ruth** and **Irving Jakobson** both died last fall. We will miss **Jake**. He was vice-president and president of our class and a very generous donor to MIT.

I learned of four other deaths this month: **Mrs. Pearl (Albert H.) Wechsler** of Boston, Mass., on October 26, 1990; **Henry Taintor** of Mission Viejo, Calif., on August 25, 1991; **Mrs. C. Harry R. Johnson**, of Point Clear, Ala., on November 22, 1991; and **Webster W. Frymoyer** of Arlington Heights, Ill., on October 5, 1991. Our condolences are extended to the families of these people.—**Summer Hayward**, secretary, Wellspring House E64, Washington Ave. Ext., Albany, NY 12203; **Samuel Lunden**, assistant secretary, 6205 Via Colinita, Rancho Palos Verdes, CA 90274

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Please send news for this column to: **Yardley Chittick**, secretary, Rte. 1, Box 390, Ossipee, NH

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Please send news for this column to: **Frederick O.A. Almquist**, secretary, 19 Griswold Rd., Wethersfield, CT 06109

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Colonel I. Henry Stern has just completed his 18th year as zoning commissioner of Palm Beach,

Fla. . . . General **Jimmy Doolittle** has celebrated his 95th birthday. Classmates, please send in any similarly noteworthy news, so that it may be included in future columns.—Co-secretaries: **Katty Hereford**, Box 5297, Carmel, CA 93921; Col. I. **Henry Stern** 2840 S. Ocean, #514, Palm Beach, FL 33480

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There is some good news to report. **Lil Drew** keeps active at her home in Laguna Hills, Calif. She was at her place in New Castle, N.H., during July and August. . . . Holiday greetings come from **Charlotte Blonsky** in San Jose, Calif. She regrets that **George**, known as the Count to many classmates, is not alive to enjoy the demise of the Soviet Union. . . . **Adele** and **Ed Kussemaul** seek warm weather at Briny Breezes, Boynton Beach, Fla. By the time you read these notes, **Elinor** and **Sam Spiker** will likely have been to several parts of the country. . . . **Gordon Lister**, '30, who spends the winter months in Green Valley, Ariz., writes that he sees **Gilbert Tarleton** and wife **Gladys** frequently and finds they are quite mobile.

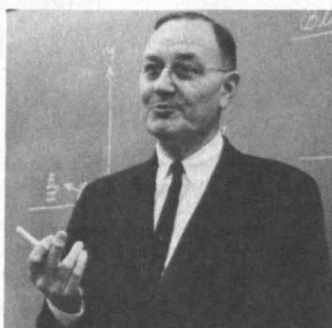
It is with sadness that the passing of six classmates must be reported. **G. Baer Connard** died on October 26, 1991, at Falmouth-by-the Sea, a nursing home in Falmouth, Maine. His home was in Bath, Maine, a captain's home built in 1897. **Baer** went to work at the Bath Iron Works in 1929 as assistant to the president. In 1941, he became general manager, a position he held throughout World War II when the shipyard produced more destroyers than the Japanese empire. After the war, he resumed his role as assistant to the president and also served as assistant VP. He retired as vice-president in 1968. During his 40-year career, Bath Iron Works constructed 229 ships including yachts, fishing trawlers, and battleships.

Baer was an avid sailor and belonged to the New York and Boothbay Harbor Yacht Clubs, and the Dublin Lake Club. He mainly sailed the mid-coast Maine area. He was a former president of the Bath Memorial Hospital, incorporator of the Bath Savings Institution, former trustee of the Marine Maritime Academy, and former chairman of the Bath Water District. He was also a former chairman of the board of Associated Hospital Services of Maine and had served on the board of directors of both Blue Cross/Blue Shield of Maine and the Maine Maritime Academy. He was a member of the Casco Bay Council Navy League, a 50-year member of the Society of Naval Architects and Marine Engineers, and a member of the Marine Charitable Trust. He was a lay reader, former treasurer, and senior warden of Grace Episcopal Church, Bath. **Baer** is survived by his wife, **Mary Hoffman MacNaught Connard**, a son, a daughter, a step-son, and a step-daughter.

Information regarding **William R. (Rick) Wheeler** who died November 2, 1991, has been supplied to me by **Gordon Lister** and **Robert A. Eugel**, '27. **Rick** retired from AT&T in 1968 having worked for that company for 42 years. Upon retirement he moved to Heritage Village in Southbury, Conn., and immediately became active as a public servant. He was selectman in Southbury from 1977 to 1986, as well as working on several town committees. **Rick** was a member of the board of directors and vice-president of association committees of Heritage Village. In addition

1900-1991

Richard Frazier



Richard H. Frazier, '23, SM '32, professor emeritus of electromagnetics, died Oct. 25, 1991 at the age of 91.

One of this country's authorities on electromechanical control components for space vehicles, missiles, airplanes, submarines, and nuclear reactors, Frazier built a lifelong relationship with MIT. Two years after receiving his undergraduate degree in electrical engineering, he returned to the Institute as an instructor and never left. He was named a full professor in 1961.

As a consultant to engineers at what is now Draper Laboratory, Frazier helped develop tiny but vital electromechanical control elements for military, space, and industrial uses. These devices helped steer the *Apollo* spacecraft to the moon and enabled the *USS Nautilus* to make the first under-ice crossing of the Arctic at the North Pole.

Frazier also led many innovations in engineering education. In the 1930s he helped develop the honors program in electrical engineering, allowing gifted juniors and seniors to accelerate their studies. During World War II he planned and taught parts of special intensive curricula for U.S. Army and Navy training.

After retiring from teaching in 1965, Frazier continued to consult with various industries, government agencies, and MIT laboratories. He was a life member and fellow of the American Institute of Electrical Engineers. □

Rick found time to be active in the United Church of Christ. He is survived by two daughters and a sister.

Communications with Cambridge broke down and the passing of **Richard P. (Tom) Price** was not reported to your secretary. Tom died on March 3, 1990. His last address placed him in Jacksonville, Fla. Tom was well-known to many classmates and served as class president for a number of years. He spent his entire working

career with Hammermill Paper Company in Erie, Pa., where he was vice-president and general superintendent.

Hopefully most classmates read the 1926 class notes in the November-December Review. That issue carried the news that **Jesse L. Maury** died April 4, 1991. Jesse came to the Institute in his junior year from Montana State School of Mining and graduated in 1925, a bonafide 1925er.

Seward S. Merrell died in St. Petersburg, Fla., on October 5, 1991. He had worked for many years for Travelers Insurance Co. retiring in the late 1960s. In his local area, Seward was known for his water-color paintings for which he won many prizes. He is survived by his wife of 58 years, Merrill Aiken Merrell.

The death of **Hyman Katz** has belatedly been reported to the Alumni Office. He died in North Quincy, Mass., on January 6, 1987. Hyman attended Harvard Law School after MIT and practiced law throughout his career.—**F. Leroy (Doc) Foster**, secretary, 434 Old Comers Rd., P.O. Box 331, North Chatham, MA 02650

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Martin L. Grossman of Charlotte, N.C., writes that he and his wife, Laura Ann, had been doing volunteer tutoring of the physically and mentally handicapped children at a local school. He's been reconstructing part of his house and helping his wife to recover from a stroke. Prior to her stroke, they had done quite a bit of traveling in the last year, including a trip to the class reunion.

As we go to press I'm afraid I have nothing but sad news as it seems most of what we hear about are deaths of class members. So please send information about something happy and positive going on in your life.

John E. McMaster of Tempest Knob Terrace, Wareham, Mass., died September 7, 1991. He graduated with a degree in electrical engineering. He was employed for 42 years with New England Gas and Electric and was director of safety for the system when he retired. He was a past master of the AF&AM Lodge in Cambridge, past president of the Wareham Community Associates, a former member of the Wareham Finance Committee, and past president of the New Bedford Amateur Radio Operators Association. He was an avid sailor. He and his wife Alice celebrated their 65th wedding anniversary in July. In addition to his wife he leaves a daughter, four grandchildren, and five great-grandchildren.

Reginald F. Terrill of Concord, N.H., died November 14, 1991. He joined his father in the W.F. Terrill Painting Contracting Co., which later became R.F. Terrill Painters. He was an active volunteer for 17 years at the Bow Elementary School, where he received several awards. In 1984 he was named Outstanding Volunteer of Merrimack County. He spent several mornings each week at the school helping about 300 children with carpentry projects. He leaves his wife of 62 years, Fannie, three sons, eight grandchildren, and three great-grandchildren. . . . **Richard W. Sherman** died in Portland, Maine, June 5, 1991. He is survived by his wife of 62 years, Elizabeth, who is in Devonshire Nursing Home, Portland.

William C. Sessions died August 20, 1991, in Grosse Point Woods, Mich. He practiced patent law for more than 54 years in Cleveland. After MIT, he received a law degree from Western Reserve University in 1930 and became a partner in Pearne, Gordon, Sessions, McCoy & Granger. He was a member of many professional associations, a trustee of the Cleveland Health and Education Museum, and a member of the Board of Fiscal Advisers of the Cleveland YWCA. He was also a member of the Bluecoats, the Newcomen Society, and the Sons of the American Revolution. He leaves two daughters, a brother, and five grandchildren. . . . **Alan W. Williamson** died September 19, 1991, in Denver. He had been a sawmill engineer and was a member of the Masonic Lodge. He is survived by a daughter.

Again, don't forget to send notes about what's going on in your life to your class secretary. Those of us who are still around like to keep in touch this way.—**Donald S. Cunningham**, secretary, Eventide, 215 Adams St., Quincy, MA 02169, (617) 328-1840

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65th Reunion

Maurice D. James who lives in Milwaukee has become a forester in New Hampshire. He and his son, Sam, have been managing a 375 acre woodlot in Northfield that has been in their family for several generations. It was recently recognized as an Outstanding Tree Farm in New England at the Woodland Owner's Association. Congratulations to Maury on your award for diligent efforts to preserve woodlands. My daughter Nancy Chase is a trustee of this Association. . . . **Theodore Ordman** of Stanfordsville, N.Y., has celebrated his 85th. Ted reports he is still recuperating from an auto accident in Florida. It required operations and lengthy hospital treatment followed by long recuperation. His wife, Vanda, too required treatment for fractures-pinning for over 13 weeks. Ultimately she had further surgery to remove the pinning. She has still not regained full mobility and strength in her fractured arm. Our sincere sympathy to you both.

Lawrence W. Day of Bridgeport, Conn., writes: "For over ten years I have been considering replacing my knee joints with artificial knees. Last week I decided to have the operation at the Yale New Haven Hospital. A neighbor, Dr. Kevin Lynch, will perform the operation which takes two hours; he does one while his associate does the other knee. The doctor said it was best to do it soon, as the bone would be worn down in another year and require a more complicated operation." Good luck, Larry. Will report on the results in the next issue. . . . **Thomas F. Russell** of Naples, Fla., died on July 12, 1991. His widow, Betty, formerly a native of London, was Tom's second wife. She wrote of his death from heart failure, resulting from a previous stroke a few years ago. He was considered not strong enough to undergo a by-pass operation. Tom made a success in the cement and sand business in Puerto Rico during the booming construction years in San Juan. They enjoyed a happy life in their beautiful home in Naples.

Thomas A. Knowles' wife Marion died on September 18, 1991, in Naples after a marriage of 62 years. They had moved to a Life-care establishment where all meals are served and a call button is handy to call for attention. With a friendly social life, this provides for an easy retirement. Tom hasn't yet become adjusted to the loss of his longtime wife. . . . **Ralph W. Stober** died on October 1, 1991, in Newton Highlands. He worked for Simplex Wire and Cable Co. in Cambridge for 35 years and became manufacturing superintendent. He lived in Newton for 60 years. I recall playing tennis with Ralph in our boyhood days on a bumpy grass court. . . . **Samuel S. Auchincloss** died on November 5, 1991, in Englewood, Fla. His wife, Lydia, survives him and sent the report of his death. Unfortunately, we have no report of his life.

Phyllis and your secretary have just returned from a trip and cruise in Southeast Asia. Flying to Hong Kong, we boarded the *Ocean Pearl* for ten days through the South China Sea and visited four cities in Malaysia. Landing at Singapore for a few days, we then flew to Bangkok. The pollution was intense, but the shrines were spectacular. The long flight back home was strenuous for a couple of senior citizens.

Try to attend our 65th Reunion, you will enjoy seeing the MIT of today and visiting with our classmates. Write **Bud Fisher**, Box 1792, Duxbury, MA 02331, or your secretary of your intentions.—**Joseph C. Burley**, secretary, 1 Harbourside Dr., Delray Beach, FL 33483; **Lawrence B. Grew**, assistant secretary, 21 Yowago Ave., Branford, CT 06405

The inevitable report of deaths of classmates this month includes **Howard Stockwell Root** in Bermuda on September 24, 1991. In his active years Howard was the pathologist at Montreal General Hospital. . . . On October 26, 1991, **Warren Greer Armstrong** died in Elkton, Md. Warren was a senior research chemist at Du Pont in Wilmington, Del. We offer our condolences to their families.

Recollections of our distant but memorable years at the new Boston Tech campus across the Charles in Cambridge were included in a congratulatory message to President Vest on his inauguration by **James McKamy White**. "Jimmy" spoke of an interfraternity baseball game in which he hit the first pitch through a window of Walker Memorial. Summoned before the superintendent of buildings, he was advised that policy required payment for the damage. He acquiesced, on condition that the ball be autographed by President Samuel (Sammy) Stratton. Remember the then campus with the wide-open graveled "Great Court," two baseball diamonds between Building 2 and Walker Memorial, football field and track behind the World War I Hangar Gym, and plenty of parking areas close to most buildings? Come to our 65th Reunion next year and get lost in the bewildering maze of the present campus.

The loyal and active women members of our class (who got their honors the easy way by marrying one of our "degreed" members) supply news of interest. Florence Jope Smith reports that **Maxwell (Max) Parshall**—retired chemist, civil engineer, and university professor at Colorado State—while afflicted with our common complaints, is enjoying lots of "music and friends."

. . . Also, **Roger Haven** is keeping his dog from being lonesome and is enjoying ice boating in Maine. . . . Frances (Fran) Donovan has received Harvard Alumni Association honors for her many services to Radcliffe and Harvard through the years, as well-deserved as for her efforts for '28 and MIT.

A letter from **Gabriel (Gabe) Disario** in Venezuela to our class agent **George Palo** indicates optimism of attending our 65th (his preference, Wednesday through Sunday). He also writes of the success of his efforts in organizing the "Association MIT de Venezuela" in 1982, now grown to 60 active members out of 200 alumni there, all helping to solve the problems of that country. Gabe is the oldest member, a native Boston boy who went to Venezuela after graduation through the influence of classmate **Mariano Contreras**, who was returning home.

George Palos feels that, due to the travel involved for many, a Wednesday through Sunday reunion will be most practical. We await your comments and suggestions to help decide, and your eventual participation. . . . The Alumni/ae Association reports contact with **James (Jim) Rae** (retired from AT&T Long Lines) and **Elliot (Tubby) Grover** (retired as textile engineer to be a professor at North Carolina State University).—**Ernest H. Knight**, secretary, P.O. Box 98, Raymond, ME 04071

William W. Saunders (wife Patricia) of Hendersonville, N.C., writes, "I had a house built three years ago in Hendersonville—enjoyed it so much that we did it again and moved into the new house July 1991. We owned the property next door so our new address is 510 Crooked Creek Ln., instead of 500. My second marriage of five years is working out great and my health seems to be good, although I have had two knee replacements and some other minor operations. . . . Best regards to all." . . . Frances H. Pierson, wife of **Olaf P. Pierson** of Caribou, Maine, writes that Ollie is now a patient in the Caribou Nurs-

ing home.

Adrian N. Clark (wife Hope) of Woodbury, Conn., has sent me a note: "I celebrated my 85th birthday and ended up bitten by a dog for which I took a tetanus shot. I am O.K. now. My motto is, stay active, you may reach 90. I walk a lot, which is considered one of the best forms of exercise. I sing in our church choir, play golf, fish, and drive ill people to their doctors, when they need me." . . . **Alan G. Reddig**, son of **James C. Reddig** of Webster, N.Y., has sent me a note, which states that his father is temporarily residing at Turner Terr., 2228 Seawall Blvd., Galveston, TX 77550, until arrangements can be made to return him to his home. Living alone is simply too much for him to handle at his age in his somewhat frail health. It would give him a boost if his classmates and friends sent some words of encouragement to his temporary address and a copy to his permanent address: 698 Lake Rd., Webster, NY 14580.

Murry M. Brimberg (wife Mary) hopes to attend our 65th Reunion. . . . **Rolf A. Zurwelle** (wife Polly) of Forest Hill, Md., has sent a brief note: "I spent more than three years at Curtiss Wright Aeronautical Co. as a project engineer. Also, during World War II as lieutenant colonel, I was in charge of the first mass production of jet engine 1-40 at the GE plant in Syracuse." . . . **Edward G. Godfrey, Jr.**, (wife Gladys) of Huntington, N.Y. writes, "I wish I could report something worthwhile like the arrival of our first great-grandchild. Only two of our 11 grandchildren are married, and neither one has shown any immediate prospects to provide what we would so much like to have." As to hobbies, he writes, "Alas, none any more—age has taken over so I no longer sail." . . . **Eric A. Bianchi** (wife Helen) of Tequesta, Fla., writes, "We again spent the summer in New Hampshire at Eastman properties and under ideal weather conditions. . . . Health-wise we are both well. Right now I am recovering from repair of a hernia which will keep me off the golf course for several weeks and curtail the gardening (the latter is a very small sacrifice)."

I regret to report the death of **Ruth C. Dean** on November 13, 1991. She was born in Swampscott on April 22, 1903. Mrs. Dean graduated with the class of 1926 at Pratt Institute and then came to MIT as a special student in the Department of Architecture with the class of 1929. She practiced as an interior decorator at the firm of Perry, Dean, Rogers, and Partners in Boston on projects for Brown University, MIT, and the Andover Newton Theological Seminary. Mrs. Dean was a life member of the Corporation of the Museum of Science, Boston, a member of St. Andrew's Episcopal Church in Wellesley where she had been a resident since 1934, and was an active member of MIT Alumni/ae Association. She was a leading fundraiser for the Boston Symphony Orchestra and other regional cultural organizations. She leaves her husband of 64 years, Robert Charles Dean, two sons, two daughters, 14 grandchildren, and ten great-grandchildren.—**Karnig S. Dinjian**, secretary, 7161 Promenade Dr., #502, Boca Raton, FL 33433, (407) 395-2890

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Those of you who took Course X-A will recall that **Ernest Tauch** was director of the Chemical Engineering Practice School station at Buffalo during the summer of 1930. Although he did not receive a degree with the rest of us in June 1930, his name appears on our class roll and his connection with MIT was much more extensive than ours. Ernest received an SB in chemical engineering from Michigan State in 1926 and soon thereafter came to MIT as a research assistant in the Research Laboratory of Applied Chemistry. He later worked as a teaching assistant to Doc Lewis in his Industrial Stoichiometry course, took a number of graduate courses, and was a Practice School field director for several years. After leaving MIT, Ernest worked for DuPont in various

technical and administrative capacities until his retirement in 1965. He and his wife Katherine now live in Wesley Manor, a retirement community in Jacksonville, Fla. They have two sons who with their families live in nearby Orange Park and are thus able to frequently see most of their eight grandchildren and six great-grand.

As many of you know, **Olin J. Stephens II** of Sparkman & Stephens had a distinguished career as a yacht designer. Although largely retired, he is still active on committees of the New York Yacht Club, the Cruising Club of America, and the U.S. Sailing Association. He also takes part in "sailing rule work" and is a director of the Mystic Seaport Museum. He and his wife Susie recently moved to Kendal at Hanover, a retirement facility on the Lyme Road in Hanover, N.H. They have two sons, Olin III and Sam, and a grandson, Olin IV. . . . **Fay and Granger Schrader** of Rosemont, Pa., recently received the Red Cross Chairman of Volunteers Award for the "thousands of hours" they have devoted to Red Cross work. This award is "the highest honor the Red Cross can give." The Schraders formerly lived in Haverford Township, where Granger was president of the Civic Association and a member of the school board.

In its November 1991 issue, the *Vancouver Sun* reported that "for 65 years former University of British Columbia lecturer **Joseph Kania** kept a blank space on his wall for the diploma he earned but never received." The article goes on to explain that as of 1926 Joe had completed the requirements for both a BA and an SB degree within five years, but because of the university's ban on awarding two degrees in less than six years, the BA was withheld. Joe later came to MIT, where he earned a PhD and subsequently had a highly successful career as a salesman and director of Pemberton Securities in Vancouver. In mid-career he became a member of the Vancouver Club, where he met a series of UBC presidents whom he "needed" about his missing degree. His reminders eventually bore fruit—at the UBC fall convocation last November, Joe finally received his BA 65 years after he had earned it.

We have notices that three more of our classmates have passed away. . . . Carol Lytle reports that her father-in-law, **Robert Lytle, Sr.**, died June 14, 1991. My records indicate that Bob worked for most of his career at Rust Engineering Co. in Pittsburgh and retired as staff power engineer in 1973. He was at one time our class VP and was living in Grosse Point, Mich., at the time of his death. I believe he is survived by a brother, Clifford (MIT '37), a son, Robert Jr. (MIT '62), and a daughter, Mary Stokes. . . . **Willard Morain** (nee Mouradian) died July 23, 1991. He worked for many years for Cooper Energy Services, a division of Cooper Industries in Mt. Vernon, Ohio. After his retirement in 1969 he continued to do consulting work there. He had many interests as evidenced by his membership in the American Numismatic Association, the American Association of Watch Collectors, the Cryogenic Society of America, the Ohio Gun Collectors' Association, the National Rifle Association, the American Radio Relay League, A.S.M.E., the Ohio Society of Professional Engineers, and he was active in the Masons. He also swam laps every day for a total of about 2,500 miles. Willard's first wife died in 1967 and he remarried in 1968. Survivors include his second wife, Norma, who now lives in Tucson, Ariz., two sons, and two daughters.

Howard Robinson has kindly sent me a note concerning the October 16, 1991, death of **Stanley Russell**, who was Howard's neighbor in Annisquam, Mass. From the newspaper Howard sent as well as from my own records, it appears that Stan was for many years president of Johnson-Foster Co., industrial and commercial painters and decorators. His company painted schools, colleges, hospitals, and industrial buildings throughout Massachusetts, with some work in other New England states and in New York. Of special interest is that his company did consider-

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able work for the Institute, including the Compton Lab, Kresge Auditorium, Chapel, and a "women's dorm." In the mid-1930s Stan also practiced architecture and did much work on homes in Belmont Hill and Brookline. At the time of his death he was the oldest living past master of the Belmont Beaver Lodge of Masons. Stan is survived by his wife Martha, two sons, Stanley Jr. of Greenwich, Conn., and Dr. Robert of Arlington, Mass., and four grandchildren.—Gordon K. Lister, secretary, 294-B Heritage Village, Southbury, CT 05614

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This issue is unusual—I have something instead of obits to write about. . . . John H. Dodge (retired in 1966), who spent most of his active life teaching science in the Irondequoit School District in Rochester, N.Y., and working on a physics text for high schools, reports that he and his colleagues have just published the seventh edition of PSSC Physics (for high schools). This course, started at MIT in 1957 under the direction of Gerald Zacharias, says John, "is still alive and kicking." John's MIT education was interrupted by World War II, being called to active duty in December 1940 for one year, which lengthened to five years, including service with an anti-aircraft battalion in the Pacific.

Edward J. Norris, whom I have seen quite often over the years, reports that he had a short tour with the CCC, then with the National Youth Administration in Dexter, Maine, and for about five years was with the U.S. Army in the U.S., England, North Africa, Italy, India, and China. Afterward he was in the Army Reserve, retiring as a colonel. After the war, he was busy looking after the water supply for Portland, Maine, as engineer and superintendent until retirement; then he was in real estate, as an appraiser, as well as building construction and inspection. In addition, he served as president of the Maine Society of Engineers, is a senior member of American Right of Way Association, and director of Atlantic Federal Savings and Loan Association. He is not only a registered engineer but also a surveyor and a member of many organizations. He has had a very good vegetable garden over the years by winning the battle with various pests, potato bugs and Japanese beetles. (From my own experience, the latter were particularly bothersome this past summer.) Recently, he has been fishing, having finally caught a striped bass, his first, which thrilled him enormously. But then, like all of us older chaps, he had to put two weeks in at the hospital—in his case for a second angioplasty. Apparently he has fully recovered, as he "feels good now."—Wyman P. Boynton, secretary, 668 Middle St., Portsmouth, NH 03801

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60th Reunion

By the time you read these notes you will have received a great deal of information concerning our 60th reunion. Thomas Weston, our reunion chair is out to make this a spirited reunion. He proclaims: "It's always fair weather when good fellows get together!"

As of January 1, the following classmates have already indicated their intention to be at the 60th: Wendell Bearce, Lawrence Berk, John Brown, Minot Bridgman, Carlos Burnett, Donald Brookfield, Melvin Castleman, Albert Dietz, Robert Dunlavey, George Falk, John Flatley, Robert Follansbee, Francis Gowen, Julius Grozen, William Holst, Harry Johnson, Max Katz, John Kearns, Charles Martin, Arthur Marshall, F.R. Morral, Alfred Mulliken, Robert Minot, Edward F. McLaughlin, Eric Newman, John Northrup, Albert O'Neill, William Pearce, Robert Prescott, James Snow, Joseph Stowell, Charles Taylor, Benjamin Wilbur, and Thomas Weston.

To those hesitating classmates who feel they won't know anyone or if they do they won't

recognize them—come—you will quickly feel at home with a special group who all went to MIT 60 years ago.

Kenneth W. Smith (510 Shamrock Villa II, 207 Lee's Summit, MD 64081) writes that he is in good health for 83 but is fighting the facts of his wife Betty's affliction with Alzheimer's disease. He would like to hear from others having Alzheimer's experiences. . . . E. Harold Anderson writes that he retired in 1971 but is still active with the Caribbean Baptist Mission. . . . Carl Wahlstrom says he cannot attend the 60th Reunion as he has had eight major operations in the last four years. He no longer can travel.

Eric Newman will attend our 60th in conjunction with attending his granddaughter's graduation from Williams College. Eric and his wife Evelyn have recently returned from Albania. "It was hard to believe," he says, "how bad communism can be." Evelyn is very busy as executive director working with the city remaking Forest Park. . . . Roy Haessler writes that all is well and he is busy as an automotive safety consultant. . . . Nick Flatley writes he is recovering very well from his back operation and hopes to be at the 60th.

Mrs. Eleanor Nealand Wrigley in reporting the death of her husband says, "I have been fortunate to have had two wonderful MIT graduates for husbands."

I received greetings from Rose and Tom Weston which contained a mimeographed letter recounting their principal activities in 1991. The main event was Tom's heart attack with complications. After a few operations and the support of family and close friends, Tom is back living a pretty full life. Tom was active for the Middleborough Public Library. He traveled this summer to New Hampshire and Nova Scotia.—Melvin Castleman, secretary, 163 Beach Bluff Ave., Swampscott, MA 01907

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Please send news for this column to: William B. Klee, secretary, Box 7725, Hilton Head Island, SC 29938

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Please send news for this column to: George G. Bull, assistant secretary, 4901 N. Park Ave., #711, Chevy Chase, MD 20815

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In the November/December issue of the Review I reported the death of Bernard Whitman. I recently received a letter from James K. Marsteller ('47), who knew Bernie well and thought we would be interested in some details of his life immediately after graduation. Bernie went to work for Chance-Vought Aircraft Division in East Hartford and later in Stratford, Conn. Jim met Bernie in June 1940, when he joined the company and Bernie became his immediate superior. Bernie was in charge of structural and mechanical testing of all Vought planes. The Vought XF4U-1 and the production version FU-1 were the first planes with which Bernie was involved. About the time of Pearl Harbor, Bernie was made head of the entire Experimental Department, which built the mockups, prototypes, test articles, and rigs for the company. He remained in that capacity until he came back to MIT to head their effort on a guided-missile program. Jim visited Bernie last May, six weeks before he died.

James E. Castle writes from his home in York, S.C. He tells of spending two years as a "short shifter" mining engineer in two mines in Colorado and two more in Utah. After two more years of "Western wandering," he accepted a professional position in the Orient. He returned to the United States before Pearl Harbor and spent the next 30 years in mining engineering, alternating

technical and operational assignments to managerial posts. In 1972 he set himself up as a consulting mineral economist for the next 12 years and had enough success financially to conclude that he had missed his calling and should have been an MBA from Harvard. Like many of us at this age, his goal is to greet in the New Year 2000.

Lester A. Brookes writes from Rockmart, Ga., that he and Ellen will be celebrating their 50th anniversary this February and will probably spend a few days in Connecticut. Les bemoans his "golf problem": for the last five years he has been "losing yardage off the tees at a steady rate" and says "if this keeps up, then by the time I'm 100 I'll be lucky if the ball goes more than 50 yards. I think that problem is quite common at this point. I'm down to 160 yards, but I bet **Leo Beckwith** will still be breaking 200."

I am sorry to report the deaths of two more of our former classmates: **Arthur M. King** on August 13, 1991, and **Joseph K. Raes** on August 3, 1991. Art King was a member of Chi Phi and crew manager as an undergraduate and played golf in the class tournaments for 25 years. He went to Louisville, Ky., as assistant treasurer and became VP of Mengel Co., in 1953. In 1961 he became president of Mengel Wood Industries, leaving when it was purchased by U.S. Plywood in 1965. He was heavily involved in community affairs and was campaign chair of United Way, VP of Fund for the Arts, chair of the Chamber of Commerce, President of the Louisville Country Club, president of St. Francis School, and member of the Memorial Auditorium Commission. He leaves his wife Nancy, with whom he would have celebrated their 50th anniversary last October 13. . . . Joe Raes joined North American Aviation at Canoga Park, Calif., soon after graduation and served as production manager, works manager, and manager of plant maintenance. He later joined the U.S. Postal Service in Los Angeles. He is survived by his wife Lillian, two children, and a granddaughter. Condolences are being sent to their spouses.

I am writing this the day after Christmas. It was a very good one for me with friends and by telephone with my six children, 13 grandchildren, 1 grandson, and a sister. Weather: Sunny, 73 degrees between two rainy days. . . . Next issue I will pass along notes from **Hal Everett**, **Stanley Lane**, and **Jim Libby** received through the Alumni/ae Association.—**Allan Q. Mowatt**, secretary, 715 N. Broadway, #257, Escondido, CA 92025

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President **Alice Kimball** completed another transcontinental trip in early December, camping and visiting family along the way. During some free time in California she got to see **Slim Beckwith** and his at-home weather station, which is part of the meso-network of the National Weather Service. Wife Dinny keeps busy as president of the local hospital auxiliary. Slim was to have rowed with the class crew at 55th, but on June 18 wrote: "bitterly disappointed not being able to attend—cold and flu forced cancellation. I wouldn't have been able to pull more than the weight of the sweep." Alice also visited Ann Marie and **Hermann Friedlaender** (Course I) at their new home in San Clemente. He continues his life-long interest in horses as an international dressage judge, and is an honorary member of a German horse breeding society. Alice talked at length on the telephone with **Brent Lowe**, who was suffering the effects of more medical tests but keeping his spirits up.

A canvass of some classmates along the New England shoreline found most of their properties unscathed by the violent storm in late October: **Bill Hastings** in Old Greenwich saw the highest water in 33 years, which rose over his car's floorboards in the basement garage, but no serious damage. **El Koontz** and **Ed Rowe** in Old Saybrook only had pools of water nearby. Vice-

president **Ken Arnold**, reporting on the Cape Cod area, wrote that he and **Francis Lessard**, **Bill Saylor**, and **Tom Charnley** suffered only broken tree limbs and some power outage. **Herb Borden's** sailboat was damaged by other boats which broke their moorings, and **Jack Zietlow's** boat at Oak Bluffs was pitched atop the bulkhead at the yacht club. On the North Shore, however, **Lou Stahl** in Swampscott lost 150 feet of sea wall which at base was eight feet above normal high water: "In 20 years I never saw the ocean so high, so turbulent, so destructive."

Alwyn Gray (Course XIII) and **Hamilton Migel** (Course II) both took trips to Russia last summer, via different modes. Al went 23 days by bus "on what must certainly be the longest bus ride in the world—I had never been to the exotic cities—now I must return to some because the schedule permitted too little time in them, and took too long covering the vast distances between." Ham and wife, Barbara, traveled by boat on canals and lakes between Moscow and Leningrad, had an enjoyable time of leisure, and left Russia just one week before the attempted coup. They were treated with kid gloves by the tour agents, and the natives seemed very careful in conversation, generally not answering questions.

A press release from Spring Arbor College in Michigan tells of **Obie Falls** receiving its distinguished service award for leadership roles in fund-raising, and effective advocacy of the college. Obie was Course VI-A and had a wide-ranging career in electrical and nuclear energy with GE, as president of Commonwealth Associates, with the International Atomic Energy Agency in Vienna, Austria, and as mayor of Jackson, Mich. . . . **Roger Krey** (Course IX-B) writes, "Barbara and I have lived in the lakes region of central New Hampshire since 1965. One of our children is legislative director for U.S. Senator Bob Smith—the old man's conservative politics really rubbed off on this kid. My number one hobby is a 1913 Model T and the Central N.H. Model T Club." Read his 50th Reunion biography for the variety of his activities, including hang-gliding, cycling, and real estate trading. . . . **Connie Bouchard** continues his restoration of exotic classic cars (see April '90 Notes). He, Roger, and **Gordon Thomas** (are there others?) should have a classic car rally. . . . **Wiley Post**, also IX-B, writes, "After a stint in the hospital with a respiratory problem, I am on the mend and returning to my normal activities. Sorry I had to miss the 55th."

Two items were deleted from my overlong report of the San Francisco trip: **Jim Seth**, Course X-A, and **Nellie** have continued their Archeological Conservancy interest with trips to the "mound builders" sites in Ohio and the famous Bandler petroglyphs west of Santa Fe, his early home town. . . . **Franklin Cooper** got a PhD in physics, but the bulk of his career was in human communication research: expression, understanding, reading difficulties, etc. He and a colleague set up a non-profit laboratory with a modest endowment and some later funding by the NIH, the National Security Agency, and others.

Cheers for the lives of **Bill Abbott**, **Jack Ayer**, **Bill Healy**, and **Norton Miner**! A letter from **Bob Caldwell** tells of Bill Abbott's dying in his sleep October 22, after a year of heart congestion. "He was Course VIII, served as major in the Signal Corps in World War II, and played a major role in the development of nuclear power with Westinghouse and Combustion Engineering." His widow Lillian told of his high regard for Doc Edgerton and his related work. She continues at 402 Farrington Post, Pittsboro, NC 27312. . . . **Jack Ayer** died November 13 while napping after some household chores. He retired in 1974 as VP-Operations of the Denver and Rio Grande Railroad. Long active in the MIT Club of Colorado, he was a strong supporter of the **John Easton Memorial Fund**. When I visited in '90 he was busy with a wide range of civic work (see July '89 Notes). A mild heart problem of many years never kept him from a vigorous life, but on the telephone his widow Rosemary told of circulation

problems the last year. She continues at 1263 S. Jackson St., Denver, CO 80210.

A letter and news clippings from Tom La Cava, '34, tell of **Bill Healy's** death November 26. Bill was Course VII, and rose to be executive director of New Hampshire water supply and pollution control. Tom worked 30 years with and for Bill and writes: "He developed and promoted one of the best water pollution control programs in the country." A tribute in the *Concord Monitor* said Bill was "a man who gave luster to the term public servant. . . the pollution abatement that evolved under his leadership could be termed the 'Healy Era.'" His widow, Mary, is in a nursing home after a stroke, but mail to 603 Union St., Concord, N.H. 03301 will be forwarded. . . . **Norton Miner**, Course IV, died December 8 in Salisbury Hospital. He was a Navy lieutenant commander in the South Pacific in World War II, and practiced architecture in Connecticut, New York, and Massachusetts. In the 50th Reunion picture he stands fourth from right in the middle row. A tribute in the *Register Citizen* spoke of 69 years service to the town on boards and commissions: "very generous and sincere. . . didn't like pomp or honors. . . brought a level of professionalism in architecture that is hard to surpass." His widow Isabel continues at 137 Salmon Kill Rd., Lakeville, CT 06039.—**Frank L. Phillips**, secretary, 1105 Calle Catalina, Santa Fe, NM 87501, (505) 988-2745; **James F. Patterson**, assistant secretary, 170 Broadway, Pleasantville, NY 10570, (914) 769-4171

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55th Reunion

It's getting closer! Have you made your plans to attend our 55th reunion? Don't put it off! (A note of interest to you golfers—the site of the first U.S. Golf Open was Newport, R.I., in 1895.)

Verner Kreuter retired in 1964 as general manager of McGraw Edison Co., Rochester, N.Y., Division. His wife, Sarah, passed away in 1981. He writes that his main interests are photography, golf, sailing, and his five grandchildren. He has four children, all of whom are married. . . . **Ed Bartholomew, Jr.**, retired in 1971 from the University of Connecticut. Ed lives in Marion, Mass., and owns and operates cranberry bogs and is a grower/owner of Ocean Spray Co. His interests are his family, cranberries, and fishing. . . . **Jim Newman** is vice-chair of Booz-Allen from which he is semi-retired. He is involved in promoting the growth of the Housatonic Valley Association, an environmental non-profit organization protecting the watershed of the Housatonic River from Massachusetts to the Sound; also past president and chair of the nominating committee of the board. His hobbies are skiing in Vermont, tennis in the Florida Keys, fishing, and lately, bridge.

Chester Kyih-z Nie lives in Shanghai, China. He retired in 1972 as senior engineer of the East China Electric Power Bureau. In fall 1991, with his wife, Virginia, he had a six-week trip to the United States. At present he is a council member of the Soong Ching Ling Foundation. During a previous trip in 1985, he visited **Charles Cardini** and his wife, Jean, in Hamilton, Mass. . . . **Charles Cardini** writes that he retired in 1985 with plans to play more golf; however, he hasn't found the time and hasn't played as much as when he was working. He keeps busy with work around the house, volunteer work, and Masonic and Shriners activities.

Sydney Mank retired in 1976 from the building and development company he owned. In 1941 he entered the U.S. Navy as an engineer in the Civil Engineer Corps. His first assignment was to rebuild the naval training at Newport and Sachuest Point rifle range. Sid is involved in the Lions Club, community volunteer work, gardening, maintaining property around the house, and helping with his wife's surgical supply loan organization, which gives free medical supplies to Ruppahannock County residents (wheelchairs, hospital beds, etc.). . . . **Bardolf Storaasli** retired in 1976 from Allis-Chalmers, Milwaukee, and is

presently working in sales for Tru-Value Hardware and is maintenance supervisor for the Duke School for Children. He is interested in music, sailing, traveling, carpentry, woodworking, and his grandchildren. . . . Received word that **Mel Prohl** (who is an engineering consultant in Boxford, Mass.) was a contributor to the recently published *Handbook of Rotordynamics*.

Sorry to report that the Institute notified me that **Robert Nedbor** passed away on June 18, 1991; **Dr. William Muckenhirn** on September 2, 1991; and **Edward Fischer** on October 22, 1991. We extend our sincere condolences to their families.

I received word from Louise Wold that **Bill Wold** died on October 19, 1991, following a heart attack. Bill received his degree in aeronautical engineering. He was president of William C. Wold Associates, an international aircraft sales company based in New York City. He later founded Air Land Corp. when he moved to Conway, N.H., in 1969. He was a licensed private pilot and glider pilot and a member of the Wings Club in New York City; he was also a hospital volunteer. Bill was looking forward to our 55th Reunion with great anticipation. Our condolences to his wife, Louise, his daughter, and four sons.—**Robert H. Thorson**, secretary, 66 Swan Rd., Winchester, MA 01890

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A year or so ago our class notes mentioned that "Tice" **Boissevain** was working on a book, *Physics of Sound and Harmony*. This, his first book, has now been published under a more descriptive title: *Tuning Tool Kit for Serious Barber Shoppers*. For you who are dedicated members of barber shop groups here is your step-by-step manual for tuning the chords while maintaining the tonal center.

Murray Hayward's daughter wrote from England to inform us of her father's death November 13. An alumnus of Course XV, he was the son of Carle R. Hayward, '04, professor of metallurgy, whom many of us knew well. Murray was with Ford Motor Co. until his retirement. He leaves his wife Doris and two daughters.

The rest of these notes come from **Ed Hadley**'s contacts and activities. From a telephone conversation with **Harold Strauss** he reports that on July 9 Harold blacked out from a heart attack and woke up in the hospital. Two and a half weeks later he was released with a defibrillator implant. Both he and Henri are now doing fine.

Ed himself during the summer and fall had what I'd call remarkable eye surgery—obtaining lens implants, the second on October 5. Now no more cataracts. He expects that for the first time since the age of ten he will be able to do almost everything without glasses, except read.

For 1990 Christmas he and Jean had a dandy picture of themselves and all 22 descendants, including the five sons and daughters-in-law. Now between Jean's playing nurse with daily drops in Ed's eyes they got their daughter Elizabeth married October 13.

Al Cushing of Georgetown, Mass., has been serving with Ed on the board of Northern Essex Elder Transport, providing rides for the elderly of the Merrimack Valley area of northeast Massachusetts. Al is now moving to Concord, N.H.

At the September 20 Class Officers Conference, while other classes were generally represented by a smattering of presidents, vice-presidents, secretaries, treasurers, and class agents, the Class of 1938 had the distinction of being represented by one officer, the sole assistant secretary president—namely, Ed, our quintessence of class officers. At the next day's Leadership Conference, Ed and Jean were joined by Nancy and **Dave Wadleigh**, **Horace Homer**, and **Bob Johnson**. That's the meeting when alumni and their organizations are honored. The MIT Club of Cape Cod was one of the activities honored, and Horace and Dave are president and past president, respectively, of that club.

On October 24–26, Jean and Ed and Carol and

Lloyd Bergeson visited MIT and met Charlie Choi, '92, a Class of 1938 Scholar for the past two years, who could not have gotten through without student aid. Note: classmates can still help build up our fund by gifts to the Alumni/ae Fund designated to MIT Class 1938 Scholarship.

Norm Leventhal is chairman of the Artery Business Committee of the new central artery and third harbor tunnel, the largest single construction project in Boston history. The committee oversees the project to ensure it doesn't interfere needlessly with business and traffic these next eight years of construction.—**Don Severance**, secretary, 39 Hampshire Rd., Wellesley, MA 02181; **Ed Hadley**, assistant secretary, 50 Spofford Rd., Boxford, MA 01921

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Hewitt Phillips is researching the history of heavier-than-air flying machines. With Viola, he presided over an informal seminar attended by several '39er experts in aircraft and one in fertilizers. Mary and **Jim Barton** (having landed safely after an autumn pilgrimage to Cambridge), **Betsy** and **Bob Withington** (after another safe landing in their Cessna), and Nancy and **John Alexander** (back from a cruise in the Caribbean) arranged a '39er mini-reunion to greet the Phillipses at the Bellevue Athletic Club. Hilda and I, retired from the synthetic manure business, drove north for 40 miles to stay over with Bob and Betsy and be stimulated by Hew's presentation and lively questions and answers afterward. Hew presented specifics about a several-second lift-off of a large biplane in the 1890s in England. The plane was designed by Maxim, inventor of the machine gun. The plane had two propellers, each about 11 feet in diameter, and was powered by, believe it or not, a reciprocating steam engine! The test was for the wheeled vehicle to lift itself up off some smooth tracks. Lift-off was achieved and lasted for several seconds until one of Mother Nature's critical aerodynamic ratios caused termination of the flight. The dinner and discussion among longtime friends made another pleasant and educational evening for all. The steam engine part interested me particularly because, without advantage of MIT's steam lab, I was asked during 1947 to install all the required process machinery and instrumentation and to train an operating staff for the first commercial dry ice plant in Brazil.

Eleanor and George Beesley's travels included Arizona, Switzerland, Austria, Lake Winnepesaukee, and Atlanta. **George Manning Morrill**, and **Paul Stanton** are busy helping **Fred Grant** extract majority preferences from their 55th reunion questionnaire. To eliminate the possibility for his having any idle moments, George accepted chairmanship of MIT's Cardinal and Gray Society, which includes all '39ers in its membership of about 9,000.

Anita and Bill Wingard retired to Catonsville, Md., and are about to learn that activities have a way of filling new spare time. . . . **Barbara and Dick Christie** in retirement after 31 years with General Electric, are living between their homes at Boulders-Carefree, Ariz., and Lake Minnetonka, Minn. . . . **Dodie Casselman** expects to leave Ft. Meyers, Fla., about mid-May to summer at Cataumet, Mass.

Sylvia and Seymour Sheinkopf summered in their motor home and report that **Sally and Dave Frankel** moved to Boca Raton, Fla., and that **Helen and Art Zeldin** are visiting New Zealand. Seymour relayed a clipping from the December 21 *Washington Post*: ". . . **Leo Weiss**, a columnist for the *Washington Business Journal*, who also was board chairman of the Ventura Clinic, died December 18 after a stroke. He founded the Ventura Clinic, a non-profit organization, in 1986. Weiss, a founding director and past chairman of the MIT Enterprise Forum of Washington-Baltimore, was cited as a "supporter of entrepreneurship" by *Inc* magazine in 1989. He was an assistant to William

P. Lear and worked in developing unmanned aircraft. After World War II, he founded AVIEN, a New York company that manufactured electronics and other material for the Defense Department. He retired as its CEO in 1975."

Adie and Bill Pulver celebrated their golden wedding anniversary at Snomass, Colo. Their other travels included Cape Canaveral, Epco Center in Florida, and skiing with the Over-70 Club in New Hampshire. . . . Christmas mail brought greetings from one classmate whose initials are prominently displayed on tens of thousands of doors in the U.S. and other English-speaking nations on planet Earth. If you haven't guessed, it's Professor Emeritus **Morris E. Nicholson**. Morrie reports he is in good voice at St. Paul, Minn., where he and Norma look forward to the '39er 55th.

Aletta and Bob Touzalin made their annual trips to England and Europe where they enjoy travel by auto and barge. On return to the U.S., they toured Nova Scotia, visited Eugenia and **Fred Cooke** at Canyon Lake, Calif., and **Yolande and Ernie Kaswell** in Reston, Va. Bob says the Cookes plan to join the Touzalins in summer 1992 at the Midlands, England, to consult about a mutual operating plan for canal boating. If my recollection is correct, Bob T., on a prior bargaining adventure, developed a sprained back, and Aletta acquired new expertise as she operated manually many canal locks.

Elizabeth and Gus Griffin continue to be active in tennis, golf, and even some white water rafting. Last summer they left home at Louisville, Ky., for a vacation at Glacier National Park from which their back-to-nature adventures started with a five-hour ride on horseback uphill to 4,000-foot elevation. They survived there for a week without benefit of indoor plumbing.

Sybil and Bob Saunders live sometimes in Atlanta, Ga., and sometimes on Seabrook Island, S.C., where they are active in the property owner's association. Bob's talents continue to be in demand and he may lend a hand in helping East Germany rebuild. . . . **Lloyd Hunter** serves on the board of directors of Cephas Attica, Inc. He goes into Attica prison at least once per week with a counseling team to work with 20 inmates in a group. They are able to turn around about 75 percent of those who agree to complete their full program after they are paroled.

We are saddened by a report of the death of **Joseph W. Harrison** on October 14 in New London, N.H. He worked for 30 years for Arma and 20 years for Airborne Instruments Laboratories (Division of Eaton Corp.), retiring as division head. . . . We have a report of the death of **Yuen N. Lee** on June 21, 1991, in San Francisco, Calif. There were no details.

At the moment of mailing these notes to Cambridge, I received news from **Gus Hunick** conveying the sad news of the death of his beloved **Priscilla** on December 18, after a long illness. Many in the class loved her and will miss her. Their marriage was "51 years of golden joy." Classmates who would like to help Gus in this time of grief may address him at 59 Horse Shoe Dr., Westbrook, CT 06498.—**Hal Seykota**, secretary, 2853 Claremont Dr., Tacoma, WA 98407

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Treasurer **Dick Babish** has sent me some of the many responses he received about the mini-reunion in Florida in January 1993. As of early December, 32 class members were definitely interested, and 26 said there was a good chance of their going. In addition, 60 people sent in their dues, many of them for the next five years. I believe that President **Norm Klivans** also received some responses to the questionnaire.

Among those who feel that there is a good chance that they will go to Florida in 1993, several sent in comments. **Tyler Marcy** writes that he plans to remarry in January and will continue to live on Cape Cod. His first wife died last summer

shortly after their 50th wedding anniversary. . . . **John Lutz** is looking forward to the reunion, and will combine it with a few days at Disney World. . . . **Al Gutttag** says that he is enjoying his new home at Asbury Methodist Village, and is especially pleased with the *esprit de corps* of the staff and the residents.

John J. Casey (Port Washington, N.Y.) will combine the reunion with a visit to his sister, who lives in Naples. He adds, "Still managing my aviation consulting business. Have been busy up until mid-September, when everything seemed to come to a halt. I expect the economy will pick up—it always has, but in the meantime, many people are being badly hurt." . . . **Samuel "Spec" Card** sent a brochure on The Math, Science, and Technology Foundation of Florida, Inc., for which he says he is "working harder and longer for zero dollars as a volunteer than I did for megabucks before retirement." . . . **George Weinbrenner** is enjoying retirement in "sunny, democratic Texas." He comments, "This year, especially on the anniversary of Pearl Harbor, I think of our classmate **Lawrence E. Teich**, Course X, who lost his life in the Philippines following the Bataan Death March. He was my roommate in prep and at Tech." . . . **John McKee** thinks that planning ahead for two-four years may be a little optimistic at our age, but "let's hope for the best." He adds that he was recently royally entertained while spending two days with Maxine and **Phelps Walker** in Atlanta. . . . **David R. "Beano" Goodman** writes that he would probably come to the reunion in Florida. For the 55th, he would prefer Cape Cod, Cape Ann, or Woodstock to Newport. Separately, he writes that, as of mid-December, he had just returned from the Mayo Clinic, where they "redid my hip. It went quite well, and I'm walking around the house on crutches. I should be out and around without cane etc. by March 1." I just spoke to Beano, and he is doing reasonably well. He expects to be off his crutches in January and hopes that this time, he will keep the new joint in place—unlike the last time.

In other news, **Joseph Greenberg** writes, "Still going to my office and doing some consulting work. Finished a book that will be published by the American Society for Metals early next year, *Handbook of Industrial Heating Equipment*." . . . **Joseph J. Casey** (Tampa, Fla.) wrote to **Dick Babish**. He says, "Sorry to learn about **Russ Werby's** passing. Phoned him in March 1990—we just picked up from our last conversation in March 1942. But he sounded just as young." Joe adds that he enjoyed the 50th Reunion, but missed seeing **Budd Robb** and **Ruth Berman**. (I have no information on either of them.)

Sadly, I must report the death of **M. Loren Wood** on October 3, 1991, after a long illness of dementia, due to small strokes. In a letter from his wife to **Dick Babish**, she characterizes Loren as a "wonderful person—kind, gentle, to say nothing of his extreme intelligence."

Rhoda called recently to tell me that her husband **Amos Joel** will receive the IEEE Medal of Honor in May. In addition, he is to receive recognition from AI&T for his 1972 invention of a switching system for cellular mobile telephones. It is always a pleasure to report honors to our classmates.

Frank Libman also called, in late November, to express his interest in the Naples reunion. He knows the area and the hotel well, as he has family there and has visited often. Frank recently sold his bottling business in Maryland and is in the process of selling off some of the equipment to Poland. He has not yet determined what to do with the real estate, so he is still very involved. His spare time is spent at his vacation home overlooking a broad river near Maryland's eastern shore.

A "Christmas Communique" from **Dick Cobean** reviews his family activities for the past year. Included were many visits with his children; a description of his aeronautical activities followed. He built a plane in his basement which was ready for its first flight in November. He is

pleased with its action.

Clement Burnap sent a long letter describing his occupations during the last few years. After many years of working for large engineering and manufacturing firms in countries throughout the world, he retired at age 65 from Kaiser Engineers. He soon began work with several small companies, each on a part-time basis. Most time is spent marketing for a forensic engineering firm, **Garrett Engineers**. Clem delivers seminars to insurance and attorney's claims offices to instruct them how the company's self-employed engineers can save them time and money. Types of claims include auto and personal accidents, equipment failures, fires, property damage, structural, water and electrical cases. He is also involved in marketing for an underground mining company that specializes in stress control in coal, salt, and potash mines. The company also deals in specialized instruments and is involved in finding solutions to the problems of the underground nuclear waste depository in New Mexico. Clem's third business is with a company expert in deep excavation, soil dewatering, slope stabilization, etc. The remainder of his time is spent golfing and at the athletic club doing aerobics and weight machine programs.

We are still working on the 55th Reunion arrangements in Newport and expect to make a tentative reservation at the Viking Hotel in the near future. In the meantime, keep those letters and notes on the way. They are what make the column!—**Richard E. Gladstone**, secretary, 1208 Greendale Ave., Needham, MA 02192, (617) 449-2421

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Maria Purvin writes that her husband, **Robert L. Purvin**, passed away on June 19, 1991. He received his doctorate in chemical engineering with our class in June 1941 after receiving an SB, with high honors, from the University of Texas in 1938. From 1941 to 1946 he worked for Humble Oil in Baytown, Tex. In 1946, Dr. Purvin formed **Purvin and Gertz, Inc.**, a consulting firm in Dallas. Since then he successively became VP and director of **Foster Grant Co., Inc.**, **Leominster, Mass.**, founded **Robert L. Purvin Associates**, was chair and CEO of **Barber Oil**, and chair of **Purvin and Lee, Inc.**, all in New York City environs. He was a fellow of the American Institute of Chemical Engineers and a member of many other engineering societies. Dr. Purvin received many awards and was known as an innovator. He developed, in concert with others, the concept of transporting liquified natural gas from North Africa by ship, using the vessel as a giant thermos bottle. He lived in Mamaroneck, N.Y. The class expresses its condolences to Mrs. Purvin, his six children, and 13 grandchildren.

The mailbox being empty of any pleasant news about classmates, I'm falling back on information about Washington area classmates. **Chet Hasert** informs me that the **Hasert, Butt, White, Hustvedt** four has ceased rowing operations for the winter. Potomac Boat Club took in their dock! More next spring. Chet's biography missed the 50th Reunion Year Book. He sent it in and is waiting for the long promised supplement to be issued. Meanwhile, here are a few highlights. "We 41ers were a lucky bunch to ride the crest of the 'golden age of aviation.' The war brought me to Wright Field to join the large MIT enclave there. . . . (In the middle of the war (I) was sent to Caltech for a year's study at the Jet Propulsion Lab. Worked on the design of the first U.S. jet (XP-59), and later flew in it at 'Muroc' (now Edwards AFB). Finished war in Germany as a technical intelligence officer surveying German jet aircraft and rocket developments. (Now Col. USAF Ret.) . . . After war and several aircraft companies, gravitated to the Pentagon to work with my Caltech professor, **Von Karman**, running a scientific advisory board for the Air Force. Worked on X-1, X-3, X-15, Dynasoar (a forerunner

of the space shuttle). Had a mid-career sabbatical at Stanford Business School, and changed my outlook on many things. Earlier, working with MDs on aerospace problems was intrigued with mathematical, systems engineering approach, so after retiring, (I) pursued medical courses at Johns Hopkins and NIH." Chet has many volunteer activities, including the MIT Club, professional societies, church, and community association boards. In his hobbies he seems to have followed the retirement advice of an "older" friend, "Don't get caught milking the cows!" They run the gamut from sailing, to white water rafting, to hang gliding. In quiet moments he's into computers, "MIDI music," fractal art, technical market analysis, and playing and building an organ.

Another frequently contacted classmate is **Robertson Youngquist**. Bob graduated with us, and his picture is in our 1941 *Technique*. For some strange reason he is carried as '39. His biography explains: "Dropped out June '38, attended summer school '39 and '40; readmitted; graduated June 1941 with thesis: *Problems in Design and Test of a Liquid Rocket Motor*." His career followed this bent: 1941-45, U.S. Navy; 1946-48, Glenn L. Martin Co., Viking sounding rocket, Matador missile; 1949-57, Reaction Motors, Inc., X-15 aircraft and missile engines; 1958-62, Institute for Defense Analysis; 1963-66, Youngquist Associates; 1967-68, Esotech Inc., nuclear rockets, Apollo, comsats, deep sea vehicles, other sophisticated studies. Meanwhile Bob was active in the American Rocket Society and its antecedent, the American Institute of Aeronautics and Astronautics, of which he is a fellow. We should have predicted all this on January 10, 1941, when *The Tech* headlined, *Rockets—Not Nazi Bombs to Disturb Institute Peace*. The article described ASME-sponsored rocket research work by Youngquist, **Frank Storms** and **John Symons**. The article included a report (unheeded at the time) that the Germans planned to use rockets as a new secret weapon.

As this goes to press on December 31, an item, composed by **Mal Abzug**, arrived: "The much traveled **Conny Nelson**, normally at home in Minneapolis, spent Thanksgiving week with Gordon and **Mal Abzug** in Pacific Palisades, Calif. The visit included museum, restaurant, and Cessna hopping, and several long hikes in the Santa Monica Mountains. Conny took back succulent cuttings from the Boyd Walker garden, to root (indoors) in Minneapolis."

Keep sending your stuff. Input I submit by May 1 appears in the August/September issue.—**Charles H. King, Jr.**, secretary, 7509 Seabago Rd., Bethesda, MD 20817, (301) 229-4459

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50th Reunion

My thanks to **Robert S. "Hawk" Shaw** for his letters full of class and other news. . . . The University of Minnesota's Mathematics Department held a two-day conference on differential equations in honor of Professor **Warren S. Loud**. In addition to the United States, France, Canada, and the UK were represented among the presenters. . . . **Jerry Coe's** committee has been hard at work on reunion arrangements. Do hope that all of you are making your own arrangements to attend. It will be an outstanding affair with activities of all sorts for everyone.

Doug McConnell reports from Exxon that the corporation will be sending matching funds to our class gift efforts. . . . **Heinie Shaw** and wife did a three-week volunteer stint with an Earth-watch team studying wild dolphins right here in the Tampa/Sarasota Bay area. . . . **George Toumanoff** is flying, riding, sailing, playing tennis, and traveling. He is also doing some international consulting "to keep from being bored." George is fluent in Russian and does considerable work with clients from the USSR. . . . **Bob Bloom** is still working hard at AB Plastics, Inc. in Los Angeles. He does custom injection mold making and plastic molding.

One obit: **Marv Stein**, who graduated in Course VIII and got a master's and a doctorate in physics at Penn State. At Tech, he was an original research assistant in the Vander Graf generator program. Our sympathy to his wife, Dorothy, and to the family.—**Ken Rosett**, secretary, 2222 Americas Blvd., N., Clearwater, FL 34623

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We have lost two more good classmates. . . . **Jonathan H. Sprague, Jr.** (Course X) died October 2, 1991, in Houston, Tex. Jon was a native of Ipswich, Mass., with strong family roots in Bar Harbor, Maine, which has become his final resting place. After receiving degrees from Milton Academy, MIT, and Harvard, he embarked on a long and distinguished career in chemical market research, gaining international recognition as an expert in the marketing of sulfur. Before retirement in 1986, Jon was associated with Monsanto, Freeport Sulfur, and Exxon Chemical. In his last years he served as a consultant to Exxon, The Sulphur Institute, foreign governments, and various other institutions. I wish I could repeat in toto the fine article about Jon from *The Bar Harbor Times*, which quoted reminiscences of his wife Crystal about their life together. Crystal also sent a note to the Alumni/ae Association thanking MIT for Jon's education. We offer our condolences to her and the rest of Jon's family.

On April 15, 1991, **David J. Crawford** (Course VI) passed away in Poughkeepsie, N.Y. Our only additional information is the name of his wife, Jean. To her we extend our sympathies.

Betty and Bud Cruckshank have sent an update on their fifteenth new address: 5965 Bloomfield Circle, Apt. 308B, Royal Wood, Naples, FL 33962. They now occupy a golf-course condo with room for overnight visitors. They still travel extensively—New England and the Canadian Maritimes in 1991—but they are happy to winter in the sunny southland.

Faithful reporters **Dick Feingold** and **Jim Hoey** have forwarded extensive articles about **Gene Eisenberg**, who graduated in Course XVII (building construction and engineering, remember?). Gene is currently CEO of the LEA Group, Boston, a multi-disciplinary engineering/architectural firm. The article in the summer 1991 edition of *Civil Engineering* at MIT recounts some of Gene's history and the activities of his firm, and highlights the problems LEA faced in building a septic (septic tank discharge) treatment plant on Cape Cod. There was great local resistance (NIMBY), spearheaded by Jim Hoey's hometown paper, *The Cape Coddier*. One editorial was unrelievedly critical, with "fearsome odors" being the mildest complaint. Nobody promised a rose garden. Right, Gene?

Notes just in from **Merton R. Hubbard**, Hillsborough, Calif., and **Dr. Richard J. Zeamer**, Salt Lake City, Utah. . . . Although officially retired, Merton has been teaching quality-control classes in county and state schools and writing articles for various journals. He had a book published last year, *Statistical Quality Control for the Food Industry*, which is now in its second printing. . . . In 1989, after 27 years in rocket propulsion, Richard retired from the Magna, Utah, rocket plant of Hercules, Inc., where he was a project engineering manager. He has since continued work at Applied Science Associates, a small consulting business. In his spare time he hikes the mountains of Utah, visits his five children, and "analyzes history using an engineering approach."

Keep the news coming and start the countdown to June '93.—**Bob Rorschach**, secretary, 2544 S. Norfolk, Tulsa, OK 74114

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Ray Froddy, Fremont, Mich., reports he is still actively pursuing nature photography and writing, as well as environmental and energy activism

(speeches and writing). . . . **Norman Greenman** has moved up the ladder from CEO and president to chairman of Rogers Corp. in Rogers, Conn. . . . **John Barmby**, Vienna, Va., retired from the General Accounting Office as of September 3, 1990. He has started his own consulting service. Initial contracts are for review of studies comparing fixed wing, rotary wing, and artillery forces for the close support mission; also review of composites for fighter aircraft.

William Cooley, Fairfax, Va., retired from George Mason University in 1991. At present, he is serving as a volunteer teacher of education reform (K-12) in the GMV in Retirement Institute and as chairman of the Technology Education Advisory Committee to the Fairfax County Public Schools. . . . **John Hoopes, Jr.**, is in his last year in the Chemical Engineering Department at Widener University after retiring from ICI Americas nine years ago.

Stan LaVallee, Harpers Ferry, W. Va., informs us he is enjoying retirement and keeping busy with gardening, swimming, skiing, volleyball, international folk dancing, and travel. Along with his wife, he spent two weeks this past summer with a folk dancing group in Bulgaria and by themselves this fall in Spain for three weeks. . . .

Lamar Field, Nashville, Tenn., sends word that he has been professor of chemistry, emeritus at Vanderbilt University since January 1990, having rounded off 40 years. With referee work and service on three editorial boards, he spends half time at the university; part of this also goes into a scientific autobiography promised to a journal. The rest of his time goes into volunteer work (radio reading for handicapped, a reading program for children, and presidency of his church congregation) as well as a bit of consulting. . . .

Richard Hinchcliff, McLean, Va., writes of the trip Esther, his wife, and he took last fall to what was the Iron Curtain countries a few years ago. They visited Hungary, Poland, Czechoslovakia, and the German Democratic Republic, now part of Germany and Austria. Dick reports that inflation has taken hold and is rising rapidly. Some idea of the fall of the dollar hit him in Austria where an Opera ticket cost \$160. Dick saved his money for U.S. Opera.

Sten Hammerstrom informs us of the passing of **Warren Howard** on September 29, 1991, in Sunapee, N.H. Warren had a long career with General Electric and Morgoil Bearings in Worcester, Mass., where he was VP of marketing, retiring in 1986 but continuing to serve on the board of directors. A long-time summer resident on Lake Sunapee in Sunapee, N.H., he served on the board of the Lake Sunapee Protective Association and was president from 1977 to 1979. He leaves his wife, Louise, one daughter, four sons, seven grandchildren, and a brother. . . . **Barbara Bettes**, daughter of **Richard Bettes, Jr.**, notified the Alumni/ae Association of his passing on August 17, 1990, in Mountain Lakes, N.J., after a long illness. . . . Mrs. Edith Barbato informed the Alumni/ae Office of the passing of **Anthony Barbato** on July 17, 1991 in Kettering, Ohio. He was retired from Wright Patterson Air Forces Research Labs where he had received the Engineer of the Year Award. He was a past president of The Philadelphia Pennsylvania Sons of Italy Lodge and a member of The Board of Trustees at The Dayton City Mission. He is survived by his wife, Edith, son Gregory, two brothers, and a grandson. We extend our sympathy to the families of our departed classmates.—Co-secretaries: **Andrew Corry**, P.O. Box 310, W. Hyannisport, MA 02672; **Louis Demarkles**, 77 Circuit Ave., Hyannis, MA 02601

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Your many Christmas notes are still buried under the tree; thus it will be the next issue before you hear about several classmates' activities.

Tom Hood and his wife, Marian, of West Lafayette, Ind., recently returned from Tegucigal-

pa, Honduras, where Tom completed his third project for the International Executive Service Corps. (IESC). Tom, a professor emeritus at Purdue and a retired executive VP at Vermont Marble Co., was recruited by IESC to assist a manufacturer of marble products with evaluating production methods and upgrading efficiency.

In late September, **Walt Borden** of St. Simons Island, Ga., wrote the following: "Having built homes for Habitat for Humanity the past several years, I recently volunteered to help restore an old church some 130 miles north of Moscow. Our hosts were members of the Russian Orthodox Church in Moscow where I spent six days with side trips to Zagorsk and Rostov before moving on to 'our' church near Tulaev."

"We had a primitive camp—no running water except for the Volga River, outhouses by Borden, and even a peasant Russian sauna with birch branch whipping, tea, plus a delicious native meal with all too many vodka toasts. Working with 20 Russians of all ages and mixed sexes was a great experience. Warm loving people whom I shall always remember. I shudder to think of their difficult future."

In early October, **Vince Butler** had a pacemaker installed to eliminate his quivering heart; in and out in less than three days all at Medicare expense, so Vince advised. . . . **Ellen and Jim Brayton** spent some time with Katie and **Jake Freiberger** at the Freiberger retreat in Durango, Colo., last September. Jake and Katie won the golf match and the Braytons won at tennis, but as Katie indicates they always let their guests win at tennis; makes them feel good!

Pete Hickey has been cleaning house, and he passed on a few 1945 gems—a photo complete with names taken at our 10th Reunion in Lenox, Mass., some sort of Philadelphia reunion held in Cherry Hills, N.J., goodness knows when, plus a Polaroid of our 15th Reunion at Snow Inn in Harwichport—and I recognize **Nick Mumford's** 's high forehead. . . . A most pleasant conversation with **Al Werner** last summer; Al's retired, but wife Jeb continues with real estate on Long Island and is able to keep him in the manner to which he has become accustomed.

A note from Ottawa's **Phil Pocock** reports that daughter Betsy, also of Ottawa, had their first grandchild, a bouncing Joanna, last October. I should add that her dad is Larry Schembri, PhD '85.—**Clinton H. Springer**, secretary, Box 288, New Castle, NH 03854

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Well, it's that time for our annual "visit" with some of our classmates who send me nice Christmas cards, which I'll synopsise in the order in which they arrived here at my Rocky Mountain shanty. And wouldn't you know that on the top of the stack is crazy **Bill Cahill**, basking on the shores of Lake Tahoe. I never know whether he's in the throes of elation or delusion, so I have to decipher his page, which is convoluted, rhetorical, and full of conflicts about some developer of a subdivision he's apparently involved with. The upshot of it is a possible move to Ireland.

Next one up is **Ken Davis**, (just turned 66) who is still merging mid-sized companies and may come through Denver with wife, Ellie, to visit one of their daughters in nearby Aurora and get in some skiing in Steamboat Springs (a very good choice). . . . **Roger Bart's** wife, Elaine, put together a Christmas motif wrapped around some nice poetics describing their doings between Beaufort, S.C., and Martha's Vineyard aboard their Aries power sailer. In between Roger's "theatrical arts" and visits with children who helped them batten down their home for "Bob's" hurricane; it was dicey but "no damages caused our lives to be permanently changed." . . . A good, long letter from **Larry Bodie**, joining us Christmas computerized writers, tells of a spell of depression following his retirement from Northrop last February, and a prostate removal in July

followed by a colon problem. Along the way, medication and some psychiatric "massage" has Larry pretty recovered. If you care to share experiences, you might drop him a note or two to 13361 Eton Place, Santa Ana, CA 92705.

A note from **Stan Young**, written by his "better half," Penny, indicates a girl grandchild born to Stan and Kristin in late 1990, making 6 grand-girls, against one grandboy from other parts of the family. Stan, since retiring, is into computers, designing floor plans for additions to one of their daughters' homes, and a very large model airplane he built (Good ole XVIer!).

Lewis Mann, Jr., has lived many years in Fresno, Calif., where he is still practicing clinical chemistry for a living, and is looking at "1459 days to retirement." In spite of never hearing from his Course V classmates, he does continue to contribute to the (general) Alumni/ae Fund.

And that, boys and girls, is a wrap.—**Jim Ray**, secretary, 2520 S. Ivanhoe Pl., Denver, CO 80222

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45th Reunion

McGraw-Hill recently published *Handbook of Rotordynamics*; the editor-in-chief is **Fred Ehrlich**. Quoting from McGraw-Hill's publicity release, "This outstanding reference offers scores of specific examples about a wide array of modern equipment, ranging from steam turbines to reciprocating engines, from electrical motors to aircraft gas turbines, and from generators to centrifuges. By stressing the design, manufacturing, and operating aspects of rotating equipment, the handbook concentrates on areas often overlooked in the literature of the field." Fred is a senior staff engineer at General Electric Aircraft Engines. He is the author of more than 40 technical papers on rotordynamics and related topics and holds 9 patents on aircraft gas turbine apparatus.

John Truxal recently received the Rufus Oldenburger Medal of the American Society of Mechanical Engineers (ASME). John is Distinguished Teaching Professor Emeritus, Department of Technology and Society, State University of New York, Stony Brook. The Oldenburger medal is given for outstanding achievements in the field of automatic control. John is receiving it for "his pioneering work in the education of control engineers, including the authorship or co-authorship of three widely used textbooks and the editorship of the definitive *Control Engineers' Handbook*, and for the many ways in which he has promoted a better understanding of the role of technology in the conduct of human affairs." John has taught throughout his career: Purdue University (1950-54), Polytechnic Institute of Brooklyn (1952-72), and then SUNY. He served for 10 years as VP at Brooklyn Poly and three years as engineering dean at SUNY, Stony Brook. Currently he is co-director of the Stony Brook Center for the Sloan Foundation's new liberal arts program. John is a member of the national Academy of Engineering, Ford Motor Co.'s technical advisory panel, the American Society for Engineering Education, and is a fellow of the IEEE, the American Association for the Advancement of Science, and the ISA.

Frank Lieu writes to tell us he's been retired since leaving a unit of General Signal in Sunnyside, Calif., in 1982. But he's not idle! He's taking 12 to 14 units at the College of San Mateo, studying piano and vocal technique, doing watercolor painting, and learning tennis! He says that keeping active helps one live an old life happily! Frank recently retired from the City of Foster Education Committee after serving for six years. He lives in Foster City, Calif. . . . **John Wittels** is living in Tucson, Ariz.—but that's all he told us in his recent note.

Wilton Fraser died February 14, 1991. He was living in Naples, Fla., having moved there four years earlier when he retired from Proctor & Gamble in Cincinnati. While in Cincinnati, he was active in his church, the Masons, and the Shriners. Wilton's wife, Mary Ellen, still lives in

Technology Day 1992

Business
&
Education

Cultural Values,
Individuals &
Organizations

Regulation
&
Public Policy

Organizational
Structure &
Design

ISSUES AND SPEAKERS

Internationally, America is no longer the richest or best educated nation. Domestically, traditional boundaries between business organizations, government, and the educational system are in flux. Competitive American participation in the world economy is dependent upon, among other things, the relationship between the individual to the work place, the structure of work, and the interactions of the educational system with the business organization.



Come share your thoughts on these issues with the likes of Lester Thurow, Dean of the Sloan School, Phil Khoury, Dean of the School of Humanities and Social Sciences, Joel Moses MA '67, Dean of the School of Engineering, Paul Gray '54 EE, Chairman of the Corporation, and Suzanne Berger, Department Head of Political Science. All eagerly await your participation in Technology Day '92.

Friday, June 5

Winds of Change: *Achieving Global Business Excellence for America in the 21st Century*

THE SCHEDULE

8:15 am

Memorial Service in the MIT Chapel

9:00 am

Technology Day program begins in Kresge Auditorium

12:30 pm

Lunch begins in the Athletic Center (\$17)

3:00 pm

Concurrent Panel Discussions
The topics of the morning will be debated in detail with provocateurs and moderators inviting alumni to participate.

5:30 pm

Deans' Reception (\$12.50)

*Graduate
Alumni/ae
Welcome!*

*More
information
to follow
in the mail*

*Questions?
Call (617)
253 - 8241*

Technology Day 1992

Naples. Wilton had a distinguished career in World War II. He flew in the Pacific Theatre with the 13th Troop Carrier Squadron, where he received the Distinguished Flying Cross and the Air Medal.—**Robert E. McBride**, secretary, 1511 E. Northcrest Dr., Highlands Ranch, CO 80126

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Dick Baker and his wife Joan enjoyed a slow trip up the California coast. Their oldest son, Richard (27), was married in San Francisco and their youngest son, Michael (16), visited colleges during the trip. Dick and Joan live in Mamaroneck, N.Y. Dick's company, Mr. Tony Clothing, is holding its own, and Dick thanks God for his partner so he could take some time off. Joan is a head nurse at the New Rochelle Medical Center Emergency Room. Their daughter, Sally (26), is with Arthur Anderson following an MBA from Tulane. She is doing exceptionally well and plans to study for a doctorate. Karin (21) is a hair dresser. Julie (20) is at UNC Chapel Hill and hopes to make Phi Beta Kappa. The Bakers spend July in Wellfleet and visit Wilmington, N.C., at least twice a year. When we lived in the dorms Dick and I shared experiences with the numerous part-time businesses we operated (independently) to earn our way. Dick sold corsages and newspapers. I sold stationery, promoted Camel cigarettes, and flipped hamburgers in the Lounge Bar in Walker.

In December, we continued our tradition of a Champagne Brunch at the MIT Endicott House in Dedham. Fortunately, MIT has been able to maintain the family atmosphere of what had been the Endicott family's home. Added to the beauty of the building is the warmth that results from a gathering of classmates who have attended previously. Each year one or two additional classmates enjoy their first visit and decide they will join us again.

This year classmates attending were: Ann and Ken Brock, Jean and Milton Slade, Judy and Graham Sterling, Anita and Verity Smith, Stan Shein and Irene Kalfon, Barbara and Malcolm Reed, Tel and Bob Sandman, Jean and Jack Juechter, Connie and Orville Bean, Mike Oglo, Mary and Bob Cowan, '49, Dot and Jim Christopher, '49, and Marty Billett.

Anita and Verity Smith used up their Pan Am frequent flyer miles in the last weeks of Pan Am's existence. They were in Africa and Germany for several weeks with many stops. . . . **Bob Crane** is as active in retirement as he was in the years before when he earned a PhD and an MD. He chose early retirement from his position as director, clinical research-cardiovascular in 1989 from Sterling Drug, a subsidiary of Eastman Kodak. His wife, Jonny, had a house in El Paso (which was being rented out) while they were in NYC and Rensselaer. This house is now their retirement home. Their Unitarian Universalist Community is but a block away, and Jonny is Sunday Service chair. Jonny serves the blind by reading local newspapers on a radio newscast transmitted to special receivers. She's back into little theatre and was in *Crossing Delancy* as the matchmaker.

Bob serves Mended Hearts, Inc. as a volunteer who visits patients who are about to have, or have just had, heart surgery. They provide support group functions to patient and family. He has had bypass surgery twice himself. In addition, he has been editor of the *El Paso Ticker* where he tried out new desktop publishing techniques. Bob is president of a computer users group as well. Bob and Jonny attend classes in arts, music, and literature at the Center for Lifelong Learning at the Univ. of Texas. After retiring from Sterling Drug, Bob served as a consultant doing library searches, analyzing data, and reviewing projects. In August 1991, he spent a month in NYC with Jonny at Sterling's request and returned again in January and February of this year. Bob serves on a Review Board for a local R&D group, reviewing protocols and ensuring patients' well-being.

They have traveled a little bit. Bob did some white water rafting. They expect to travel more, Bob says, "if and when our various activities calm down—you know—when we retire."

John Kirkpatrick recently visited his first grandchild, a boy, in Florida. John lives in Greenwich, Conn. . . . **Orville Bean's** wife, Connie, is on the staff of the Health Dept. at MIT. Connie recently published *The Better Back Book* (Morrow). The book resulted from her research in finding corrective exercises to relieve back problems. Her newest book, *Women Murdered by Men They Loved* (non-fiction) will be published this spring. . . . **George Clifford** recently completed three years service on the committee that plans Technology Day in June. Last year he was chairman of that committee. He has been appointed to a two-year term on the board of directors of the Alumni/ae Association. . . . **Jack Page** was elected to the board of directors of IMCO Recycling, Inc. in Irving, Tex.

Barney Devins, 81, is slowing down in his 18th year of retirement. Due to emphysema, he has found it makes no sense to chase young girls. It requires strenuous effort and diligent planning to keep from becoming a couch potato. His wife, Kay, is his most precious asset. It's been a 48-year love story. He sends his regards to his old Westgate buddies. . . . **John Farrow** is enjoying life in Dewey Beach, Del. He is a SCORE counselor, involved in town government as chair of the board of adjustment. He is a former town mayor and police commissioner. He celebrated his 43rd wedding anniversary and enjoys five grown children and ten grandchildren—two of whom are already in college. . . . **Russell Lawton** lives in Sonoma, Calif. He retired in December 1990 after a successful selling career. He had a bout with cancer, which he apparently has licked. His recent blood tests are encouraging. Russell enjoys retirement and wonders how he found the time to work. Sonoma is a busy, friendly town and there is time to smell the grapes! . . . **Ken Stickney** is serving as secretary/treasurer of the MIT Club of Southeastern Massachusetts.—**Marty Billett**, secretary and president, 16 Greenwood Ave., Barrington, RI 02806, (401) 245-8963

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William S. Edgerly, the successful chairman and chief executive of State Street Boston Corp., yesterday said he would retire next year, and named Marshall N. Carter to replace him." So stated a lead article in the business section of the *Boston Globe* on December 20, 1991.

Continuing, the *Globe* said: "At a time of severe problems in the commercial banking industry, Edgerly's decision to reduce State Street's lending in the 1980s appears well-timed. He built State Street into the nation's largest provider of securities processing and record-keeping for mutual funds. The firm has \$1 trillion in assets under custody."

"Edgerly's retirement, although expected, would end a successful 17-year tenure at the helm of State Street. Edgerly said he would spend next year smoothing the corporate transition."

Paul Ostergaard writing about his career, reports that, after leaving MIT and working in insurance for a while, he went back to Tech for a year, lived in a house in Westgate, and studied what was to occupy most of his life—acoustics. From 1954 to 1959, he served as a staff engineer and acoustical specialist working throughout Carrier Corp. From 1959 on, he became a consultant in acoustics eventually founding his own firm, Ostergaard Acoustical Associates. During his career, he has been active in 14 technical societies, in two of which he is a fellow. He is associate editor of *Sound and Vibration* magazine. He holds the Silver Beaver and Award of Merit from the Boy Scouts of America and is a prime mover in almost all aspects of the governance of the Presbyterian Church in the United States. He is the author of 16 technical papers.

In closing his letter, Paul writes: "Since I sold my business about three years ago and only work part-time, I find that I have no time for work with the activities to which I am committed. That seems to be a common problem for everyone who has retired that I have been talking to."

Charles E. Smith, retired VP of Panelfold, Inc., in Miami, Fla., has recently returned with his wife, Florence, from Karachi, Pakistan, where he served as a volunteer with the International Executive Service Corps (IESC). IESC is a not-for-profit organization of American business men and women devoted to providing managerial and technical assistance to private enterprises in developing countries. Since 1965, the organization, with headquarters in Stamford, Conn., has completed over 13,000 projects in 95 countries. Mr. Smith was recruited by IESC to assist a wooden pencil manufacturer with improving lead-making production.

Once again, **Jack Fogarty** has favored us with his always-interesting Christmas letter. This year he reports on a trip to Hawaii with the Astronomical League, ostensibly to see the eclipse but at least as much to see the geology. They were overwhelmed by the lava. It's everywhere, he says. "The whole place is made out of it and that's what you see unless man decided on something else. And it comes in such amazing colors, textures, shapes, and sizes. . . . We climbed 13,700-ft. Mauna Kea and went 10,000 feet up Haleakala to see the tremendous caldera with all its cinder cones. They told us Manhattan would fit inside the caldera." Jack is still enjoying optical computing at Westinghouse.

Blair Manning writes that he and his wife, Emily, were members of an elderhostel in Costa Rica in February 1991 to learn about the country's history, economy, culture, and rain forests. He highly recommends this type of trip for anyone who wishes to visit Latin America. In July, they spent a full week in Minneapolis at the Special Olympics. He and Emily worked as Spanish language announcers in gymnastics arenas as volunteers. "A very rewarding experience."

On the back of his application to attend the September mini-reunion on Martha's Vineyard, **Ed Capen** wrote: "I retired from Rockwell International Corp. in Downey, Calif., in 1989 after 17 years of involvement in design and control in the space shuttle program as a project engineer."

In a note to the secretary, written last November, **Walter Seibert** reports that: "About two years ago, we decided to move from New Jersey to Houston since we no longer had business interests and had retired. No place is perfect, but we found many advantages here. Last month we drove through 17 states and 5,000 miles to visit six children, 13 grandchildren, and our 91- and 89-year-old mothers."

John Alger, in Rumney, N.H., tells us: "My wife and I keep busy with SCORE (Service Corps of Retired Executives) counseling (both of us), while she works in the Rivers Campaign, and I am the town moderator and member of the advisory board to the Lakes Association. I am also active in NSPE, am editor of *Engineering Ethics Update*, and keep up with three grandchildren plus country home chores."

Jim Marshall is enjoying early retirement from Villanova University while still teaching one course per semester in his specialty of audio-frequency. His musical activities continue apace. His arrangement of J.S. Bach's aria "Bist Du Bei-mir" for string orchestra has recently been performed three times by a local chamber orchestra.

Many of us shift focus successfully as we go through life and **Benjamin D. Cowley** is an example. Having majored in chemical engineering, he is now a criminal prosecutor for Cecil County in Elkton, Md.

My wife, Nell, and I were saddened to learn of the death in St. Louis of **Paul E. Weamer**, 67, on December 5, 1991. We had known Paul and his wife, Ginny, quite well when they lived here in Needham, Mass. Paul had left his house in fine spirits on his way to teach an evening class in

marketing at Washington University. En route, he had a massive heart attack and died at the wheel only a few minutes away from the house. Paul was president of his own consulting firm in St. Louis, Sales Management Services. Paul leaves his wife, Virginia; four daughters, and one son. He is also survived by a sister and six grandchildren. A funeral mass for Paul was conducted in Needham. Representing the Class of '49 were Pam and Micky Ligore, Marjorie and David Moore, and Nell and Fletcher Eaton. Paul was very active in MIT affairs and, according to his wife, Ginny, it would have been his wish that contributions in his memory be made to The Alumni Fund, Alumni Center, Cambridge, MA 02139.

Warren W. Houghton, 68, died October 20, 1991, at his home in Manchester-by-the-Sea, Mass. Warren was a retired mechanical engineer with the Raytheon Company missile systems division. He served in the Army in Europe and the Philippines during World War II and received a bronze star. He retired from the Army Reserve in 1983 as a lieutenant colonel. He leaves his wife, Patricia (Mulally), two sons, a daughter, a brother, and a sister, and three grandchildren.

Philip A. Lynn, 67, a construction engineer until his retirement in 1987, died of congestive heart failure in Winchester (Mass.) Hospital October 29, 1991. Philip worked for the Turner Construction Co. of New York and John Bowen Co. of Boston on projects such as the Lemuel Shattuck Hospital in Jamaica Plain, Lynn (Mass.) City Hall, and for the Army Corps of Engineers in expanding Hanscom Field in Bedford, Mass. Philip was a past grand knight of the Reading (Mass.) Knights of Columbus. He leaves his wife, Priscilla (Davis), two daughters, a son, four brothers, a sister, and three grandchildren.

On behalf of the class, I extend our deepest sympathies to the families of these three classmates.—**Fletcher Eaton**, secretary, 42 Perry Dr., Needham, MA 02192, (617) 449-1614

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Please send news for this column to: **John T. McKenna**, secretary, 182 Midpine Rd., Box 376, Cummaquid, MA 02637

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WaveMaker is a new software package that allows students to visualize, manipulate, and understand the diverse principles embodied in wave phenomena. Students can experiment with different variables to learn about the interactions among components. They can make predictions about the behavior of simulated waves, a swinging pendulum, buildings, or bridges without having any extensive background in mathematics or higher physics. This innovative program in part is the brainchild of Professor **Charles Whitney**. The program won the first prize in a national competition in physics education sponsored by *Computers in Physics*, a publication of the American Institute of Physics.

The opportunity to establish a pre-engineered metal building plant in Turkey was so tempting that it lured **Jerrold D. Title** out of retirement. He is currently in Istanbul with his wife, and they are enjoying an experience that he terms "absolutely magnificent."—**Martin N. Greenfield**, secretary, 25 Darrell Dr., Randolph, MA 02368

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40th Reunion

I recently accepted an invitation to breakfast from **Burge Jamieson**, the object of which was less nutrition than information. Burge was providing an occasion for a group from MIT to tell some alumni about charitable remainder trusts, with MIT, of course, as the charity. Someone with an appreciated asset that produces little income might use such a vehicle to convert the property

to an inflation-protected life income, receive a tax deduction for a charitable gift, avoid capital gains tax, and help MIT, too. There was opportunity for only a short conversation with Burge, but we parted affirming our intention to see each other at our 40th Reunion this June. Burge's invitation came on the letterhead of Jamieson & Co., which gave no hint as to what product or service the firm offers. From the address, however, I would guess that Burge is still in the venture capital business.

It is just a short distance down the street from Burge's office to the office where **Burt Richter** presides as director of the Stanford Linear Accelerator Center. Burt has been chosen VP-elect of the American Physical Society. In the usual course of events, he will become VP, as one might guess, and then president.

Cliff Herdman writes that he has completed 40 years at the Port Authority of New York and New Jersey as a senior airport planner, and he has had an exciting career watching aviation grow. He and his wife, Doris, are planning to move to Cape Coral, Fla., when his approaching retirement takes place. With six grown children between them, they expect to have lots of company.

Francis Spinelli has been promoted from vice-president to president and COO of Aerospace Metals, Inc., of Hartford, Conn.

I was sorry to learn that **Ablert L. McManus**, Jr. died last November 3. He was retired from Pratt & Whitney, where he had worked as a mechanical engineer for many years. He has also served in the Navy during World War II.—**Richard F. Lacey**, secretary, 2340 Cowper St., Palo Alto, CA 94301

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Please send news for this column to: **Gilbert D. Gardner**, secretary, 1200 Trinity Dr., Alexandria, VA 22314, (703) 461-0331

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I apologize for missing the last two issues. As some of you may know from press reports, the University of Bridgeport has been having an interesting but trying time over the past several months, struggling to keep alive. In early November, I moved from provost to president of the university, and the struggle continues as I write these notes. In any case, the holiday break is providing an opportunity to try to catch up with the Class of 1954.

Cesar Quintini reports that he is a management and technology transfer consultant and is working on the development of vacation facilities for ecological tourism in the rain forests near his hometown of Monte Carmelo, Trujillo, Venezuela.

... **John Moran** has retired from his position as a program engineer in the Ordnance Systems Department of General Electric in Pittsfield, Mass. He was with General Electric for 32 years. He and his wife, Ann, have two children and one grandchild and continue to live in Pittsfield.

... **Marty Brilliant** took early retirement from the Bell Laboratories two years ago, but is now working with Winnertech Corp. under contract to Bell Laboratories. Marty lives in Holmdel, N.J.

Fred Holmes, Avalon Professor of the History of Medicine at Yale University, has published *Hans Krebs: The Formation of a Scientific Life, 1900-1933*. Volume 2, tracing Krebs' life from 1933 to 1937, will be published this year. The books are being produced by Oxford University Press, and Volume 1 has already received very good notices.

... The annual Christmas letter from Elaine and **Rog Griffin** tells us that Rog has knocked "a bunch" of strokes off his golf scores, and that their daughter JoAnne was married last November. She is the third of the Griffin children to be married. ... **Cathy** and **George Schwenk**'s cat, Crathern, has again produced their annual Christmas letter, informing us that George is

busy trying to help start-up companies, but the economy is taking its toll. George also continues his Boy Scout work as district activities chairman. ... The first Eigel grandchild arrived in December. Our daughter, Mary, and her husband, Jay, produced Andrew Jerome.

Francisco Torras died last October 3 in Boston. He was a Jesuit priest and taught at Fairfield University and Boston College. ... **Peter Bishop** died on September 29, 1991, in Portland, Maine. He was chairman of the Chapman Corp. and owner of Bishop Packaging and Bishop Instruments, all located in Portland. Our sincere sympathies go to Peter's wife, Joy, and to the families of both Peter and Francisco.—**Edwin G. Eigel, Jr.**, secretary, 33 Pepperbush Ln., Fairfield, CT 06430

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Plenty of news this month, but unfortunately, some of it unhappy news to report. We received belated word that **J. William "Bill" Tyler**, Course III, Sigma Chi, had died in February 1990 after a very brief bout with bone cancer. Bill had been manager for Quality Assurance/Metallurgy for Hamilton Foundry in Harrison, Ohio, and was very active in local civic, church, and club associations, including serving as Boy Scouts scoutmaster for ten years and teaching Sunday school for 25 years. He is survived by his wife, Jean, three daughters, and six grandchildren. ... Another belated notification of death concerns **Joseph A. Kissinger, Jr.**, Course V, who died in June 1990.

On a happier note, **John Lindenlaub**, Course VI, writes that he has been a faculty member in electrical engineering at Purdue since 1961. He spent the 1990-91 academic year on sabbatical at Rose-Hulman Institute of Technology, where **Buck Brown** is department chair. John has been honored by being elected to Fellow grade by ASEE in 1988 and by IEEE in 1990. ... **Lester Lee**, Course X, tells us that after a number of years in the business world, he has returned to engineering, now associated with the Department of Energy, primarily in the New Production Reactors Program. All three of his children have become or are becoming lawyers, "redistributing wealth instead of creating it." ... **Rod Joblove**, Course XVI, checks in again, informing us that he retired in July 1988 after 33 years of R&D for the Air Force at Wright Patterson AFB, and since December 1988 has been basically a full time "road bum." He did, however, do valuable and interesting work as a paleontological assistant (National Park Service volunteer) at Dinosaur National Monument for six months in 1991, and plans to return for more in 1992.

Ash Stocker, Course XV-A, graciously answered our plea for news. His 9-year-old daughter, Elizabeth, is entering third grade and is among the smartest in the class (she no doubt takes after her father!); she also went to the MIT summer camp and became an accomplished swimmer. Wife Martha has left her job as VP, Human Resources at Project Software and Development, Inc., after 13 years, and is now trying to buy an existing travel agency in Lexington, Mass., which will exercise her entrepreneurial skills. Ash teamed up with a couple of other guys to form a new company, BioMetrics, Inc., which provides services to the biotech industry such as bioprocess engineering, project management, and validation. They recently became affiliated with R.G. Vanderwell Engineers in Boston and have a number of exciting projects and proposals under way. Ash had an article published in the May/June 1991 issue of *Pharmaceutical Engineering* dealing with the development of biotech facilities.

Bob Greene's Christmas card note informs us that his duties as Associate Director of the Media Lab at MIT keep him fully challenged as the lab continues to expand. Weekends at his house in Cummaquid on Cape Cod are spent biking, four-wheeling Sandy Neck beach, picnicking, walking, and golfing, to fill all his spare recreation time.

Wife Edie enjoys quilting for the MIT Women's League and is taking three art courses; also working at learning golf to keep Bob company. They plan to go to golf school in Florida next March and should be demons on the course after that!

Dave Nasatir writes that the great Oakland fire of last year was pretty scary, as they live about a mile (as the spark flies) from the site of the main blaze. He and Marilyn had spent the previous year in Florence, where he was the resident director of the California State University International Program in Italy. They ended their stay there by heading for home on their tandem bicycle—riding to the coast, taking the ferry to Corsica, cycling there for a while, embarking for Marseilles, then more bicycling, trains and ferries until they eventually flew back to Berkeley from England. Now, Dave has resumed his weekly commute to Los Angeles State University. He gets accused by his students of being an old hippie because while in L.A., he sleeps in a camper parked by the gym. Otherwise, his wife, two daughters, and six grandchildren continue to enchant him and leave him little time for much else. They did see Toby and **Dave Brooks**, who visited them in Florence, see **George Rubissow** occasionally when he is at his vineyard in the Napa valley, live fairly near to Anita and **Bob Kolenkow**, and had dinner with **Eldon Riley** a couple of years ago. Dave urges classmates to look him up when passing through the San Francisco area and promised to make it to the next reunion.

Keep those cards and letters coming! Co-secretaries: **Roy M. Salzman**, 481 Curve St., Carlisle, MA 01741; **James H. Eacker**, 3619 Folly quarter Rd., Ellicott City, MD 21042

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Charles Joyce reports that he is retiring from Ernst & Young and will be relaxing in the Vienna, Va., area. . . . **Martin Reiss**, senior VP and director of Cerberus Technologies in Boston was elected to the board of directors of the National Fire Protection Association. . . . **Walter Storer** retired from government service as a civilian in the Navy and has moved with his wife, Dorothy, and dog to the woods of Wedderburn, Ore.

Donald Barnby is cofounder of Biolog, Inc., in Hayward, Calif. The firm received the coveted "R&D 100" award from *R&D Magazine* at formal proceedings at the Museum of Science and Industry in Chicago in September. Biolog received this honor for developing a new technology in microbiology to identify yeasts; their two main kits identify over 700 species of bacteria in two major bacterial groups. Biolog's customers include hospitals, universities, food processors, pharmaceutical, cosmetic, and biotechnological companies, and many government agencies.

IN REMEMBRANCE of **Herbert C. Burrowes, Jr.** who passed away October 1, 1991 in Hudson, Mass.: Curt was affectionately known as the "Answer man" for his knowledge on a broad range of subjects. Curt Burrowes worked at the Laboratory for Nuclear Science at MIT and then on optical systems at Lincoln Laboratory. In 1984 he established Burrowes Research Machining in Stowe. He was a life-long runner and at one time a world-class pole vaulter. He is survived by his wife, Katherine, of Concord, three sons, and their families.

IN REMEMBRANCE of **Stanley L. Lopata** who passed away on October 9, 1991 in Natick, Mass.: He was a physicist and metallurgist at the Army Materiel and Mechanics Research Center in Watertown, Mass. He is survived by his father, Stanley Lopata, of Springfield, a sister, two nephews, and a niece.

The first Class of 1956 annual "Come Back to MIT" get-together will occur during the Alumni/ae Weekend June 4-7, 1992. Watch your mail for details. Send news to: **Ralph A. Kohl**, co-secretary, 54 Bound Brook Rd., Newton, MA 02461

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35th Reunion

Dave Colling reports that, after 15 years at the University of Massachusetts at Lowell, he has finally tackled a management job as chair of the Industrial Technology Department. His main interests are materials and safety in manufacturing. "Although I haven't strayed far from the Boston area, my love is my country home in central New Hampshire which provides the outdoors (hiking, biking, and cross-country skiing) for my family."

Lavette Teague has been appointed chair of the Computer Information Systems Department at California State Polytechnic University in Pomona. . . . **Richard Mortensen** retired last July as a professor of electrical engineering at UCLA after 26 years in teaching. He writes that he will now be free to attend a class reunion for the first time. . . . **Steven Mason** is now chair and CEO of Mead Corp., Dayton, Ohio. He was previously vice-chair.

Art Bergles, dean of engineering at RPI, has received the Donald Q. Kern Award of AIChE for "major contributions to the field of enhanced heat transfer." He was also recently elected a Fellow of ASHRAE for contributions to research in thermal engineering. . . . **James Wenskus** received the Engineer of the Year Award from the Rochester Section of the Society of Plastics Engineers. He is a senior engineer with Eastman Kodak Co. He holds four U.S. patents, and has been active in an almost unbelievably broad range of professional and voluntary activities over the years. He is the current president of the MIT Club of Rochester.—**John Christian**, secretary, 23 Fredana Rd., Waban, MA 02168

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Spring is here and let's hope it has rallied both our spirits and our stocks! My New Year's resolution is that someday I will look back and compare some of these short-term predictions and aspirations, written three-four months before the class notes appear in print, and see how they've panned out. Anyway, happy spring!

In the overseas pouch this month was a note from **Francisco J. San Miguel** who tells us, "After spending the last three years in Moscow, we have been transferred to London by McDermott International. I'll be the general manager for marketing activities in Europe, the Middle East, West Africa, and USSR (Russia?). We found Moscow very interesting, but London somewhat more comfortable!"

Jim Benenson continues as CEO of Vesper Corp. in Philadelphia. Jim recently joined the board of directors of SL Industries in Mt. Laurel, N.J. . . . **Arnie Amstutz**, previously president of Advest Group in Hartford, Conn., has resigned to pursue other business ventures.

Dick Rosenthal sends word that "I'm still at Polaroid (over 23 years!) and am working on medical imaging equipment. My daughter is trading bonds in New York and my son is in law school. I'm pleased to announce that I was remarried this past June to Carol Kadish and we are living in Winchester." . . . **Dick Barone** continues to provide consulting services in metallurgy to a number of clients, but says "I always have time for some additional clients. I also have been pursuing opportunities through MIT and they have been an extremely helpful resource. I recently participated in an MIT telethon and spoke to many old friends and classmates."

Over the holidays, Nancy and I started packing for our move to Connecticut in January '92. I've accepted a new position with Walbro Automotive Corp. as general manager, Meriden Division, a major supplier of fuel pump modules and systems. For Nancy, this move is "Back to the Future" because her first teaching position after college was at a Meriden High School. Since we'll be living temporarily in an apartment while we househunt, you can reach me at work or send

class news to MIT for forwarding.—**Mike Brose**, secretary, 1619 Greenleaf Boulevard, Elkhart, IN 46514

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Please send news for this column to: **Allan S. Bufford**, secretary, Office of the Treasurer, MIT, 238 Main St., Suite 200, Cambridge, MA 02142

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Class president **Jorge Rodriguez** sent me the Course VI., annual noting the appointment of **Roger Mark** as Grover Hermann Professor in Health Sciences and Technology. Congratulations, Roger. . . . The *Boston Business Journal* recently profiled **Richard Bertman**, president of the Boston Society of Architects. The focus was on Richard's architectural achievements in Boston, noting that a building he designed, 116 Huntington Ave., "is a true gem in the Back Bay's office market [and] pay[s] tribute to earlier times when buildings were designed on a more gracious, human scale." Richard is a founding partner of Childs Bertman Tseckares, Inc., a firm begun in 1967. . . . **Rick Hedrick** continues to explore new ways to use his Commodore computer. Rick's latest project is to use the Commodore as an aid in solving the Beale Cypher, key to finding a chache of gold hidden in the last century near Montvale, Va.

The *Wall Street Journal* reports that **Richard Rogers** has been appointed president and CEO of Electronic Associates, Inc., in West Long Branch, N.J. Richard formerly was CEO of BTU Engineering in North Billerica, Mass. . . . **Lawrence Kravitz** writes from Aberdeen, Md., that daughter Clara is a sophomore at the University of Delaware, and daughter Jennifer a high school junior. Larry is currently working on a project to evaluate an assault gun for Army airborne forces.

Finally, putting on my class agent's hat for a moment, I would like to thank particularly the 302 (43 percent) of you that contributed \$154,000 to last year's Alumni/ae Fund. The first quarter FY 92 figures show that your noteworthy support for the Fund continues. In December 1991, you should have received the report on the first award of our class's Endowment for Innovation in Education. Again, many thanks to all of you who made the endowment possible.—**Frank A. Tapparo**, secretary and class agent, 15 South Montague St., Arlington, VA 22204

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Well, we don't have John Sununu to kick around anymore. From the papers he seems to have made some enemies during his stint in Washington. I wonder whether his experience will discourage other people from entering government.

Rear Admiral **Millard Firebaugh** is still working for the government. He writes that since last June he has been the deputy commander in Naval Sea Systems, where he is involved with ship design and engineering. The Firebaughs are right in the midst of the action, living in Alexandria, Va. . . .

Ed Hessler is not working for the government. He is corporate VP in charge of Upjohn's chemical division in Kalamazoo, Mich. He's had that job for a couple of years now. . . . **Jim Kee** writes that he taught English to the Japanese for three years in Japan. Now he is back in the U.S. teaching English as a second language at the University of Tennessee in Martin.

Last summer I got a very nice letter from **Eric Essene** but misplaced it for a while. It's found. He wrote that he has been on the faculty in the Geology Department at the University of Michigan in Ann Arbor for the last 20 years. He went to the top and is now a full professor with 15 PhD students to his credit. He also won Michigan's first Sokol award for excellence in graduate

education. Congratulations! He goes on to say, "I have finally given up serious building and mountain climbing. Fortunately I do lots of hiking and fishing, especially when teaching at our summer field camp in the Jackson Hole, Wyo., area, and with ongoing field work in the Wind River Mountains and northern Ontario. After seeing our two daughters (Michelle and Karen, both born in Australia) through the universities of Wisconsin and Illinois, I have remarried Joyce Budai. We have been fortunate enough to have two more children (born in the U.S.A.: Adam, 4, and Zachary, going on 2). Zachary was born some three months early, but seems to be doing well now." Thanks for the letter, Eric. Eric enclosed a newspaper clipping about the Sokol award. It says he specializes in metamorphic rocks and has pioneered the application of chemical thermodynamics to metamorphism. There is a nice photograph showing Eric at the bench looking like he did 30 years ago!

There was an editorial in *Electronic Design* last November that dealt with **Bob Pease's** biweekly column "Pease Porridge." It turns out the column is "consistently one of the best-read sections in the journal! Bob's column in the November 21 issue was a report of our June reunion! As a service to all of us, he listed some of our lost classmates—the ones who don't have a current address in the cavernous MIT Alumni/ae Association files. Perhaps they don't want weekly solicitation letters. Bob is a reunion nut! This year he "reuned" with his grade school, with Mt. Hermon, with MIT, with people from Phibrick, and with MIT outing clubbers on the west coast at the home of Gardner Perry, '63, in Seattle. He said the Phibrick reunion was the best. It was scheduled for a gravel bank across from Phibrick. Fortunately a Hilton has been built on the spot, so they had to reunite at the bar.—**Andrew Braun**, secretary, 464 Heath St., Chestnut Hill, MA 02167

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30th Reunion

Albert Blackwell has been appointed the Reuben B. Pitts Professor of Religion at Furman University in Greenville, S.C. Dr. Blackwell has been on the Furman religion faculty since 1971. He received an SB in physics and then attended the Harvard Divinity School where he received a PhD in Christian theology. He has written *Schleiermacher's Early Philosophy of Life* (Harvard Theological Studies, publisher) and translated Hannsdieter Wohlfarth's *Johann Sebastian Bach* (Fortress Press). Blackwell is involved in peace and justice education and is founding chairman of The Piedmont Peace Resource Center. He received Furman's Meritorious Teaching Award in 1977. We are impressed by Albert's insights and achievements in theology and religion which have evolved since his undergraduate education in physics at MIT.

John C. McCloskey, my old Course III buddy, has been appointed as a metallurgist with General Electric Research and Development in Schenectady, N.Y. John was with Crucible Steel Co. in Pittsburgh from 1964–68, then a research fellow at Carnegie-Mellon from 1968–1973. From 1973–75, he was senior process engineer with Texas Instruments in Attleboro, Mass. He then moved to L. G. Balfour Co. (the manufacturer of the MIT brass rat) where he was director of technology from 1975–1988. His most recent position prior to joining GE was as principal of Ten Mile River Associates of North Attleboro, Mass. John and his wife Grace have two sons and one daughter, and will be relocating from North Attleboro to the Schenectady area.

Neil Doppelt has been named managing partner of the Products Division of Andersen Consulting's Chicago office. Andersen Consulting is a technical services division of Arthur Andersen & Co., S.C. In his new position, Neil will supervise

400 professionals who provide client services to the manufacturing, food, retail, and wholesale distribution, printing and publishing industries. The division's clients included Amoco, Baxter International, Caterpillar, Commodore International, Kraft General Foods, Quaker Oats, Sears, Roebuck & Co., and the Chicago Tribune.

David H. Koch was honored last November in New York at the Sixth Annual Achievement Awards Dinner of the Institute of Human Origins (IHO). David serves as treasurer and director of the Berkeley, Calif., Institute which is dedicated to the recovery and analysis of fossil evidence for human evolution and the establishment of a chronological framework for geological and evolutionary events. The president of the IHO is Dr. Donald C. Johnson, renowned for his discovery of the world's oldest fossil humanoid skeleton, "Lucy." Mr. Koch is executive VP, chemical technology, at Koch Industries of Wichita, Kan., and New York City. Dave has many diverse interests as he discussed at our 25th Reunion. We congratulate him on his contributions to the understanding of human evolution and the honor bestowed by the IHO.

Speaking of human evolution, we have come around to the time of our 30th Reunion, and the committee has quite a plan of events for our enjoyment at MIT from Thursday, June 4, to Sunday, June 7, 1992. Tech Night at the Pops, that ever-popular annual event on Thursday night will kick things off for the MIT Class of 1962. On Friday, we will share in the Technology Day program "How Can American Organizations Excel in the 21st Century?" and have special tables at the annual Technology Day Luncheon. Friday evening we will dine at the MIT Faculty Club with presentations by some of our superachieving classmates. The Saturday program will focus on the issues of K-12 education and feature prominent speakers from education, government, and the business world, followed by an open discus-

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sion. This will be followed by the Third Annual "Techsas" Barbeque and Alumni games. A dinner/dance is planned for Saturday night at a picturesque Boston location. Sunday brunch will be held at the Charles Hotel in Harvard Square. Dave Stare's vintner's artistry will be served at many of the class events. There will be ample opportunity to visit with our classmates and their spouses, children, friends, and significant others. We hope to see you at the 30th Reunion.

Even if you can't make it to the reunion, please drop me a line whenever you have the opportunity.—**Hank McCarl**, secretary, P. O. Box 352, Birmingham, AL 35201-0352

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Don Benson actually used my electronic-mail address to send a class note. It's the first time someone has done that, and I am really thrilled. So is Don: "I have not sent a class note since I graduated." He communicates with his son at UMass by e-mail and plans to send more class notes soon. Don's Internet address is dbenson%drcoal.decnat@drcvax.af.mil.

Carl Dover was appointed group leader of theoretical nuclear physics at the Brookhaven National Lab in July 1990. . . . More recently, **Michael Lukas** became director of engineering for Wisdom Systems, a software company supporting knowledge-based engineering automation. He lives at 429 Ridgewood Dr., Eastlake, OH 44095 (a new zip).

OK, you all know it's the season for "indoor activity," that is, writing class notes. Tell us all about your kids and grandkids, places you've visited and plan to visit, and all the good stuff that will let your classmates know who you've become since we all escaped the Tute. Remember, our 30th reunion is little more than two years away—time to start planning to attend. Let me hear from you!—**Phil Marcus**, secretary, 3410 Orange Grove Ct., Ellicott City, MD 21043, (410) 750-0184, CompuServe 72047.333, Internet: 72047.333@compuserve.com.

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Happy Springtime! To those of you in the northern hemisphere and to those of you in the U.S. good luck with the 1040s. There are just a few Alumni/ae Fund notes and news releases to pass on this issue.

Larry Rabiner notes that in September 1990, he was appointed director of the Information Principles Research Laboratory at AT&T Bell Labs. Activities taking place in his lab include speech signal processing, image processing, DSP implementations, hearing, communications acoustics, and interactive systems design. Larry's two daughters both attend Cornell—one is a junior majoring in international finance and law, the other is a freshman in engineering and computer science. . . . Almost a year ago, **Ron Gilman** was elected by the members of the Tennessee Bar Association as a delegate to the American Bar Association's House of Delegates. He is serving a two-year term in the 500-member House, which is the policy-making body of the ABA.

From two press releases, we learn that **Alan Gamse** was recognized as one of the top insurance regulatory lawyers in the U.S., according to a survey by the *National Law Journal*. Also, he was recently appointed to the Council of the ABA's Tort and Insurance Practice Section. . . . The American Association for the Advancement of Science announced publication of its 1991 *Science and Technology Policy Yearbook*. **Al Teich** served as co-editor of this year's edition as he has in past years.

I had a delightful phone conversation with **George Piotrowski** last night. He has been successfully coping with some fairly serious bone tumors. Between surgery, chemotherapy, and George's ability to poke and prod the medical system, it appears that things are improving. George has kept up his consulting practice and is also

keeping busy with professional society activities. His passion for trains remains undiminished—he traveled from Gainesville, Fla., to a meeting in San Diego by way of Seattle in order to ride Amtrak's coastal route. Linda has opened a bookstore featuring children's books, son Mark is enjoying the University of Florida, and Eric has polished his cartooning skills on the staff of his school newspaper. Keep on winning the battle, George!

As I write this, winter has hit here in northern New England. Louise and I are looking with great anticipation toward our two-week, late January golfing visit to the Palm Springs, Calif., area. After that, it will be time to start getting mentally prepared for Jennifer's graduation from Vanderbilt in May—"Me? The father of a college graduate? You must be kidding!" . . . Please send notes of reassurance, commiseration, or whatever. Thanks.—**Joe Kasper**, secretary, RR 2, Box 4, Norwich, VT 05055

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Archie Bleyer reports that his son Keith recently graduated from Santa Clara University and his other son Kevin is a junior at Stanford. Archie is head of pediatrics at the University of Texas M.D. Anderson Cancer Center in Houston. He holds the Mosbacher Chair in pediatrics and chairs the Children's Cancer Study Group, the world's largest children's cancer research organization. . . . The Mathematical Association of America reported that **Sharon Ross** has been elected second VP. Sharon teaches mathematics at DeKalb College in Atlanta.

Ken Ross reports that he is now president and CEO of Pillar Corp., a Macintosh software company in Foster City, Calif. . . . I enjoyed talking with **Bruce Morrison** recently. He's deeply involved in his own legal practice helping those involved with the new Immigration Act. . . . I tried to talk with **Harry Ellis**, who had written MIT saying that *Tech Review* never published his notes. I think he took me as a crank call. To Harry and all the others out there who haven't gotten through—WRITE. I would like to broaden the circle of classmates who regularly share experiences through this column.

My group, Beacon Venture Management, announced the recent formation of Environmental Quality Corp., which focuses on pollution prevention. I will be president as well as continuing as a managing director of Beacon. My last company, American Superconductor, had a successful public offering December 12!—**George McKinney**, secretary, 33 Old Orchard Rd., Chestnut Hill, MA 02167, (617) 890-5771

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We have another published author in the class: **Thomas McDonough's** new science fiction novel, *The Missing Matter*, went on sale nationally at the end of 1991. . . . **Victor Rosenberg** is now assistant professor of management at Keene State College, Keene, N.H.

Since those are the only two new news items I received this month, I shall be forced to regale you with tales of our family. Bill is working on a project in Florida that should allow him the luxury of missing the entire Buffalo winter. I am taking my very last class ever prior to the CPA exam in May. I shall be very glad to be done with school for a while (another 25 years and then a PhD). We shall be back at MIT in June when Cheryl gets her master's in materials. The cat. . . . I'll save that for next time.—**Eleanor Klepser**, secretary, 84 Northledge Dr., Snyder, NY 14226-4056

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25th Reunion

It's not too late to make arrangements to attend our 25th Reunion June 4-7 at MIT. A record at-

tendance is expected, and a good time is guaranteed. Do attend. . . . In January **Dave Sanders** accepted the position of general manager of the Production Systems Division for the Grass Valley Group, located in Grass Valley, Calif. Grass Valley Group is a leading supplier of broadcast electronics for the television industry and is a wholly-owned, independently operated subsidiary of Tektronix. . . . **George Starkschall** has been elected to the board of directors of the American Association of Physicists in Medicine. George is an associate professor of radiation physics at the University of Texas. . . . **Bob Rosenberger** is a member of the PA Consulting Group in Hightstown, N.J., as a principal in the Health Care Sector Group. He writes, "The transition to less invasive surgical procedures from the traditional open procedures has created a number of business strategies and product development opportunities." Bob, his wife, Stephanie, and their 11-year-old twins live in Cincinnati.

James Williams, Jr., one of MIT's premier teachers, has been appointed to MIT's School of Engineering's Professorship in Teaching Excellence for a five-year term. His contribution to undergraduate teaching has been recognized through a number of awards, including the Everett Moore Baker Award for "outstanding undergraduate teaching" in 1973 and the inaugural J.P. Den Hartog Distinguished Educator Award in the Department of Mechanical Engineering in 1981. He is also known for his commitment to minority student development and to increasing the number of minority faculty at MIT.

I am saddened to report the death of **Preston Pollack, Jr.**, age 57, on November 27, 1991, at his home in St. John, U.S. Virgin Islands. Preston was the founder and former president of the Boston architectural firm of Professional Designs, Inc. He lived in Newton Centre for 20 years before moving to St. John in 1987. He leaves his wife, Joan; his daughter, Leslie Klingsberg; two sons, Preston Ganson Pollock III and Philip Gregory Pollock; two sisters; and three grandchildren.—**Sharlotte** and **Jim Swanson**, secretary, 878 Hoffman Terr., Los Altos, CA 94024

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Mike and Gail are spending six months in Japan on temporary assignment, so the pleasant duty of compiling class notes is mine. Finally a task to justify my title as class president!

Lots of news to start my endeavors off right. It is New Year's Day as I write this and I trust your 1992 is off to a good start. **Paul Ware** and his wife, Carol, are still living in Soughton as they have for 20 years. Their son Erik graduated from UMass last year and daughter Jennifer is a freshman in biomedical engineering at B.U. Paul has been VP, quality assurance at Kiddie Products, Inc., in Avon for the past six years and is still having fun. . . . **Paul Kimball** is in his third year of night law school at Catholic University in Washington, D.C. He is working as a patent agent/consultant with Foley & Lardner in Alexandria, Va. . . . **Bill Hutchison** reports he is "messing about with C++, SVR4, XIR5, Actor, and Windows 3.1." I guess I have been away from non-Mac computers for too long to understand this but trust he is having fun.

Jim Carlo writes briefly to share that he and his wife are, like Mike and Gail, about to celebrate their 25th wedding anniversary. . . . **Karla Karash** reports that she is back in the world of transportation, having joined EG&G Dynatrend, a "dynamic and fast growing company." Husband **Rick Karash** is doing something new also, teaching "Systems Thinking" to executives. Their daughter Ann is in ninth grade and loves science, evidently a genetic predisposition. . . . **H.G.A. "Harry" Hall** is a principal and founder of Edge Information Group, a new data processing consulting firm in Des Plaines, Ill. They specialize in education in the high-end IBM mainframe environment.

On the academic front **Roy Shapiro** has recently been named Philips Professor of Manufacturing at the Harvard Business School. Congratulations, Roy. Roy's professional focus is on production and operations management, logistics, and supplier management. . . . **Dan Harris's** eldest son is a sophomore in Course VI, a resident of East Campus. Dan observes that "MIT continues to uphold the highest standards in technical education. It's still nerd heaven."

And now for the big news—the baby contest. Almost jokingly in October we described Anne and **Bill Carlson's** son, Ripley John, born May 3, 1991, as a "bid for the youngest child at the 25th Reunion." Their early lead has been eclipsed! Roxanne and **Randall Warniers** wrote promptly to announce their own bold bid, second son Brett Michael who arrived into this world on May 10, 1991. Randall is an editor of the Lincoln Laboratory Journal and continues to work as a free-lance photographer and teacher of photography. Sorry, Randall, because **Stanley Cygelman** and his wife Jane Jones have subsequently brought Jacqueline Anne, their first, safely into babyhood on June 6, 1991. Stan also reports that he is still living in the Boston area and is a partner specializing in corporate and intellectual property law at Kassler and Feuer. The competition is indeed getting fierce. Anyone else planning to enter please get those cards and letters in to us ASAP. Stanley asked if there will be a prize. Does anyone have any tasteful suggestions?—Your ad hoc secretary, **Rick Lufkin**. Please continue to direct your correspondence to Mike and Gail's address; they shall return. Remember the reunion; more on this next month!—**Gail and Mike Marcus**, secretaries, 8026 Cypress Grove Ln., Cabin John, MD 20818

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Woody Allen is reported to have said, "There are two major questions for our time: One is, 'Is there life on other worlds?' and the other, 'Is life possible in New Jersey?'" To which classmate **Peter R. Busch** provides a terse answer: "Am alive and well with my three kids in N.J." . . . **Alan and Ardeth (Eisner) Millner** write that they are living in Lexington, Mass. with their two teenage children. Alan has recently become manager of the Electronic Systems Group at EML Research, a division of Kaman Corp. . . . **Richard A. Parker** writes that he is still working for Conoco, Inc. in Houston. "My older son, Joel, graduated from Stanford in June. Jeremy is in his third year at the University of Montana. I am getting married right after Christmas [1991] to Betty Miller, whom I met through a singles group we belong to."

A news release from Arthur D. Little, Inc. reports that **W. David Lee** has been named managing director of technology development and product consulting. In his new position, he will direct all technology and product development consulting services, including the core business services: product and process development, contract research and development, and technology-based consulting.

Mark A. Wuonola was recently named director of chemical sciences with responsibility for medicinal and physical chemistry at the Du Pont Merck Pharmaceutical Co. of Wilmington, Del. Mark joined Du Pont in 1976 after his PhD and postdoctoral work at Harvard with Professor Woodward. . . . **Michael Cohen**, a specialist in neural network models of vision, speech, and language processing, has been granted tenure at the Boston university College of Liberal Arts. He joined the BU faculty in 1980 and is now an associate professor in the Cognitive and Neural Program and is director of the University's Computation Laboratories.

Finally, for those of you who like *Glasnost* stories and who have not heard this one: on December 18, Martin Fleischmann gave a standing-room-only talk at MIT: "Cold Fusion: A Status Report." He had been invited by Professors Louis

Smullin and Peter Hagelstein.—**Eugene F. Mallove**, secretary, 171 Woodhill-Hooksett Rd., Bow, NH 03304

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Our mailbox is full this month. Our thanks to everyone who is writing. **Jim Kornberg** writes from Boulder, Colo.: "My wife Sally, daughters Mariah, Jamie, and Terra, and I continue to enjoy our lives in the Rockies. Late in 1991 my first book, *Kornberg's Operation Guideline Series in Occupational Medicine*, was published as part of a new medical series by CRC/Lewis Publishers. Volume I will address the physician's role in performing a 'Workplace Walkthrough' and conducting an occupational medical causality analysis, and will introduce a new paradigm called PATH-MAX, which derives medical surveillance parameters from workplace hazard analysis data."

Howie Bluestein tells us that he spent the last six months of 1991 also in Boulder teaching a special graduate-level course in mesoscale meteorology for the National Weather Service and UCAR. His wife, Kathleen, was a visiting professor at the University of Colorado. Last spring Howie measured wind speeds as high as 287 mph in a tornado in Oklahoma with a portable Doppler radar. . . .

John Huchra reports he has been the associate director of the Harvard Smithsonian Center for Astrophysics for more than three years. Last year he won the American Association for the Advancement of Science Newcomb-Cleveland Award and the Aaronson Prize in astronomy and was elected to the American Academy of Arts and Sciences. Quite a year, John!

Raul Arriaga informs us that after having spent 16 years in the Venezuelan oil industry in finance, technology transfer, and international trade, he has now become the president of the Venezuelan Industrial Credit Fund. . . . Closer to home, **Ken la Bresh** says that while continuing his private practice in cardiology in Rhode Island, he was promoted last July to clinical associate professor of medicine at Brown University and was named president of the Rhode Island affiliate of that American Health Association.

Barry Bochner is chair, VP of research and development, and co-founder of Biolog, Inc., which last year received the "R&D 100" award presented each year by *R&D Magazine* for the 100 most significant technical products in the world. Biolog's product is a new technology for identifying bacteria and yeasts that Barry says holds the promise of unifying the identification of virtually all bacteria and yeasts under a single chemistry for the first time in history. Biolog has two main kits to identify more than 700 species of bacteria, one of which covers virtually all human, animal, and important plant pathogens, as well as many other environmental bacteria.

It has come to our attention that **Ron Stauffer**, a Washington partner in the law firm of Sonnenschein, Nath & Rosenthal, is the chair-elect of the Employee Benefits Committee of the Tort and Insurance Practice Section of the American Bar Association. . . . **Anthony Booth** writes: "I am living in northwest New Jersey with my wife, Roney, and three sons. I work at Warner Lambert, where, as director of scientific affairs, I am responsible for locating new business opportunities based on outside new technology. I would love to hear from any classmates in the area—call (201) 540-2580."

Not too far from Anthony is **David Luchaco** in Macungie, Pa. He is continuing his activities in Lutron research and development and is active in the IEEE Power Electronic Society, in which he is chair of the PELS Standards Committee. . . . We close with a message from **Steve Cooper**, now of Sherman Oaks, Calif. He visited MIT for the first time in five years last spring and reports, "The Institute sure has changed since 1970, not necessarily for the better in my view!"—**Greg and Karen Arenson**, secretaries, 125 W. 76th St., Apt. 2A, New York, NY 10023

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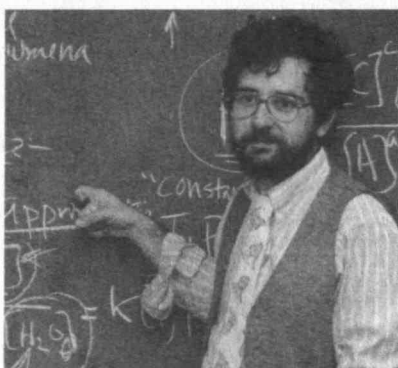
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Growing Scientists in Alaska



Ranier J. Newberry, '75, has turned his difficult undergraduate experience into a source of benefit for his students at the University of Alaska. As associate professor of economic geology for nine years, he has the praise of students and colleagues, and last year he received the Professor of the Year award for the State of Alaska, given by the Council for Advancement and Support of Education. Newberry has one of the highest teaching loads in his department and one of the heaviest advising loads in the College of Natural Sciences. Students have given his courses the highest ratings in the college.

As a student at MIT, Newberry says he felt that his professors were primarily interested in their own research and that he was "just tolerated as a necessary part of conducting research." Going into teaching may be a way to heal his own wounds, Newberry observes. While his research is important, it is secondary to his interactions with students, he notes. "I think they know that." He believes that his greatest responsibility is to teach students how to become scientists. "You can't believe how much fun it is to see people training themselves to be professionals," he says.

Newberry's advising load is also a way of compensating for what he felt was lacking in his undergraduate days. He enjoys helping out undergraduates who are still wondering what to do with their lives. "It's great when they discover that they don't have to do anything, that they can find what they like to do and that's the right thing." As a teacher, he has spent several summers in charge of the Geology Field Camp in Alaska and includes his students in research field trips to California and Nevada.—*Susanne Fairclough* □

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Peter V. Hwoschinsky writes: "Recently appointed technical manager of the FAA Vertical Flight Program Office, currently investigating the use of advanced rotor craft and civil tilt rotors in tilt wing aircraft to provide downtown intercity commercial passenger transportation." . . . **David B. Rhoads** has been appointed assistant professor of medicine at Harvard Medical School. His laboratory is in the Massachusetts General Hospital Cancer Center located in MGH-East, Charlestown. . . . **Mary Ellen** and **Ronald G. Ort** live in Flemington, N.J., and have a new baby, Deborah, born January 28, 1991. He is a patent attorney for the Lipsome Co., a small pharmaceutical company in Princeton.

Avi Ornstein has been traveling. He took his whole family to Hawaii and he and his wife, Bernice, went on a one-week cruise to the Bahamas. He is presently working with the Connecticut Department of Education on a program to identify a common core of learning and to develop a series of tasks to measure student success at achieving those goals. It is an NSF Funding Program.

Harold H. Nussbaum writes: "I am finishing my third year as assistant executive secretary for Mennoite Central Committee U.S., the relief service and development agency of the Mennoite Church. The closest parallel I can make is to say that we're a Christian Peace Corps. My work involves administration with people and programs attempting to assist and encourage poor people here at home. Our overseas counterpart has about 500 volunteers in 52 countries. My wife, Gloria, and I are enjoying life in Pennsylvania and are getting used to being grandparents (our grandson is now 1 year old)."

Please send me your news.—**R. Hal Moorman**, secretary, P.O. Box 1808, Brenham, TX 77834-1808

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20th Reunion

As you read this, our 20th Reunion is only two months away. If you have not yet paid your class dues, please do, and please plan to join us in Cambridge June 4-7 for the great activities being planned by our class president **Bonny Keller-mann** and her dedicated committee. Thursday, June 4, will be Tech night at the Pops and our class activities will start Friday evening, June 5. Hope to see you there.

Paul F. Levy left his position as executive director of the Massachusetts Water Resources Authority in mid-February 1992 after four and a half years. He managed the investment of over \$1 billion in improvements to the Boston-area water and sewer system. Thanks to him, Boston Harbor is no longer "the dirtiest harbor in the nation" and is well on its way to restoration as a magnificent resource for New England. Paul neglected to mention what he is now planning to do. . . .

Nathaniel Fisch has been appointed director of graduate studies for and director of the program in plasma physics in the Department of Astrophysical Sciences at Princeton University. He holds four patents for his work.

That's it for this month's news. It's warm and sunny here in Florida, as I write this hoping that you had a merry Christmas and a happy New Year. I will look forward to seeing many of you at the reunion. If you have not been receiving information about it, please make sure that the reunion office has your current address. (I know from experience that it can take a while for all departments to get new addresses.) . . . Please send us more news, or better yet, come to the reunion and tell us in person!—**Wendy Elaine Erb**, co-secretary, 6001 Pelican Bay Blvd., Apt. 1003, Naples, FL 33963; **Dick Fletcher**, co-secretary, 135 West St., Braintree, MA 02184

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Frank Politzer is happily remarried with a growing family, Kaylon and Carey. Frank is with a large cardiology group practice in Reading, Pa., in both interventional and non-invasive techniques. He is also developing a data-base management and report generation system for echocardiography laboratories. . . . **Dan Morris** writes that after 12 years, "we" finally launched the COMPTEL telescope in April, 1991. His group is now getting back pictures of gamma-ray bursts and solar flares.

George Langlais reports on his family: son Mike ('98) is a junior planning for college, and Christopher and Becky are close behind. Langlais Software in Nashua, N.H., is having a good year, and has started a training affiliate in Woburn, Mass. George was last year's "Instructor of the Year" at Northeastern in computer science. He calls his teaching chores "a kick." . . . **John Mack** recently received his second Meritorious Honor Award for managerial excellence while on his State Department duty in Algiers.

Daniel Shalom is a staff neurologist with the Norton Medical Group in San Francisco and is attending at Mt. Zion and California Pacific Hospital. . . . **David Moylan** is distinguished in medicine as well, having been elected to the board of the American Society of Therapeutic Radiology. His textbook, *Introduction to Clinical Radiation Oncology*, was published last November.

Automotive consulting work at A.D. Little has taken **Laddie Cook** across Europe and Japan this year, but this exciting work aside, it is Laddie's three kids who keep him challenged with their math homework. . . . **Jerry Croan** is still president of Caliber, a Fairfax, Va., consulting firm with 40 employees involved in applied social science research. Recent projects have included operating the National Clearinghouse of Child Abuse and Family Violence and work with drug treatment programs. Jerry's two teenagers keep him and wife Sandi busy.

Aaron Roberts works at Goddard Space Flight Center studying interplanetary turbulence. Wife Laurie is a psychiatrist, and they have three children, Shoshana and twins Alia and Zoe. . . . **Alan Lehotsky** is about to begin his fourth year at the Open Software Foundation as project leader for the next release of OSF/1, their Unix-compatible OS. He insists he can be both manager and standup comic with OSF. He has a son thinking college and a daughter confronting kindergarten.

Andrew Chao is practicing maternal-fetal medicine at the Santa Clara Valley Medical Center in San Jose, where wife Anne is an anesthesiologist. Next year is to bring a lifelong dream to their Morgan Hill house—a model railroad in the garage. . . . **Paul Battaglia** is a principal in the Buffalo architectural firm of Hamilton Houston Lownie. Current work includes restoration of Kleihan's Music Hall and a new college field-house and pool to be used in the World University Games next year. Paul is also teaching a course in lighting and acoustics at SUNY-Buffalo.

Tom Harrison is director of the Heart Center at Geisinger Medical Center, a referral center in Pennsylvania. He and wife Carolyn recently adopted two Colombian children. . . . **Steven Hansen** has been elected a fellow of ASM International. He is supervisor of steel product development for Bethlehem Steel, and his award was for "outstanding contributions to the fundamental understanding of the physical metallurgy of microalloyed and dual phase technologies and their application to steel products."

We regret to note the passing of classmate Dr. **Charles Scott** in Boston at age 41. Born in Indonesia, he had been director of immunology for Repligen Corp. in Cambridge and worked on their HIV project.—**Robert M.O. Sutton, Sr.**, secretary, "Chapel Hill," 1302 Churchill Ct., Marshall, VA 22115

The reason there hasn't been a column in here for two or three issues is there hasn't been enough news to write about until now. No excuses, just the facts, ma'am.

This past summer the MIT Press published a book entitled *From Gaia to Selfish Genes: Selected Writings in the Life Sciences*. **Stephen Jay Gould** is one of the featured authors in this anthology covering controversial aspects of biological research today. Steven is also quite enthusiastic about his equestrian and golf pursuits. . . . **Paul Levy** announced he is leaving the post of executive director of the Massachusetts Water Resources Authority as of mid-February. Paul said he has accomplished or set in motion all that he had hoped to do and wanted to avoid the problem in public life of staying too long in a particular position. God Paul, *What* are you going to do for an encore?

The latest word from **Bruce Schobel** places him back East since a year ago. Bruce is a tax actuary for New York Life Insurance Co., living near Princeton, N.J., and commuting 100 miles a day on the train. "New job, but same wife and kids!" says he. Bruce, that's the way it's supposed to be.

Everybody gather around in a big circle and work up a big "awwww". For **Andy Elliott**, Andy moved from the warm dry desert of Arizona to the wilds of Ann Arbor, Mich., following a job change from McDonnell Douglas to Mechanical Dynamics, Inc. "We produce multibody system analysis software. The opportunities here are great, but the weather is another story." Awwwww.

If you want to see what you've written quoted at length, always remember to include a compliment. Normally I shorten long notes, but if you have something to say, flattery will get you everywhere. Take **Frank Gulla** for example. Last spring Frank was elected vice-chair of the Tidewater Section of the AIChE. This spring he will move up to the chairmanship. "In spite of my chemical engineering background, I spend 80 percent of my time running and programming computers. When I was an undergraduate, I always said I would learn about computers when I needed to. Now I manage two computer systems and have two microcomputers at home. It seems my words came true with a vengeance." Frank concludes his note by saying what a great job your faithful scribe is doing.

Elizabeth Scarito is continuing the good fight through medical school. She's planning to graduate in May and take a residency in internal medicine. Eventually she sees herself practicing in occupational and environmental medicine. Phil is juggling a full-time engineering career, shuttling Michael to daycare, and running the house. . . . "I am alive and well and still at Alcoa in Pittsburgh," writes **John R.H. Black**. "Weathering the current downturn in the metals industry and a major reorganization. Greetings to all my fellow graduates from Course III." . . . **John Hixson** is serving as an affordable housing planner and developer for the city of Newton, Mass. . . . **William Schwab** is completing a master's in taxation at Temple University this winter. He was recently promoted to COO and CFO of the Ciotti Companies, a regional real estate company operating in New Jersey, Pennsylvania, and Delaware. Their third child was born last year, making the crew Elizabeth, Michael, and Alexandra.

Jumpin' **Jim Gokhale** recently returned to the States from over a month in India. . . . **Sandy Yulke** is on the road to a PhD in materials science at the University of Wisconsin at Madison. She was recently in Boston over the Christmas holidays. . . . **Ron Frere** and his new venture are at the "high burn rate" stage of start-up. Ron is providing business management and controls to law firms that aren't large enough to hire their own staff. He and Cyndee want to say "Hi" to all, and Ryan, Alexander, and Andrew are "growing like weeds."

A press release from the Department of the

Navy notes that **Manual Malagon-Fajor** recently reported for duty in Pearl Harbor, Hawaii. . . . Writing on big *Windows Magazine* stationery, **Paul Schindler** says he is now editor-at-large of that august publication. "I'm not in charge, but I am having fun." Paul can also be seen regularly on public television on the "Computer Chronicles" show. . . . The Quote of the Month comes from Mark Twain: "You are not your fault."—**Lionel Goulet**, secretary, 115 Albemarle Rd., Waltham, MA 02154-8133, (617) 899-9694

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Quite a few items this time. **Harlan R. Davis** reports, "My chosen career as an airlines pilot has gone through some dramatic gyrations. My company, Midway Airlines, declared bankruptcy in late March 1990, I was furloughed in July, and the company was sold to Northwest Airlines in early October. Currently, I am still furloughed, but my future with Northwest is much brighter than at Midway. Midway Airlines would have ceased operations within 24 hours had the sale not been negotiated. What a business!"

And this from **Lila Kung**, "The past year has been quite eventful. I have completed my second book, *World Markets for Analytical Instrumentation in Process Control*. Consulting has also been keeping me busy; I have done marketing studies in the areas of sensors, recorders, data acquisition, and fiber optics in industrial applications. On the personal side, I am once again single, though with two teenagers, hardly free."

I received a letter from **Marc Rosenbaum** which I would like to share with you: "The end of 1991 still finds me in Meriden, N.H., living with the same sweetie, Kate Read, now for almost eight years. (Kate is the director of education for the 10,000 member Hanover Consumer Coop.) We are in the second home that I have built. . . . I've now run my one-man architectural design and engineering business, Energysmiths, for over 12 years. I still specialize in environmentally friendly design, incorporating solar and superinsulation strategies with nontoxic construction. Business has been very good these past two years, in spite of a moribund construction economy. . . . Recently, two other designers and I landed a major design job on Martha's Vineyard over 20 competing firms by emphasizing our specialty of environmentally friendly design. In addition to designing homes, I have an active consulting practice to builders and architects and also teach energy efficient design and construction to builders and architects for several electric utility sponsored conservation programs. Writing for some magazines and speaking at conferences rounds out my efforts.

"Avocationally, Katie and I spend our time cycling, backpacking, and cross country skiing (on the rare occasions we have snow). Travel continues to be one of my main interests with trips to Tanzania, Kenya, and Japan in the past two years. No children here, but I am once an uncle with twin nephews on the way in April!"

"I don't see too many from our class—**Matt Scott** is now a professor at Stanford Med, with a new son; and **Ely Sachs**, also with a new son, is a professor at MIT. **Anne McKinnon** is a pediatrician in Northampton and mother of two."

David S. Kelly dropped a line to report on his early retirement, as follows: "Well, a funny thing happened on the way to leisure. A year and a half after my early 'retirement,' I find myself consulting in computer graphics about 35 hours a week! My wife and I are still delighted with the changes we made and feel very lucky to be living in such a wonderful community as Eugene, Ore."

I received a much-welcome holiday greetings from **Susan A. Fuhrman** (family photo included!) who had this to say: "I have become a true academician and am now on the faculty of the University of Minnesota, Department of Laboratory Medicine and Pathology. I am director of critical care chemistry and laboratory medicine

education. I also love being a mom. Charlie Lasky (MIT class of 2012) is a joy and Larry (Lasky, '72) and I love being parents." Great to hear from you!

And finally, a birth announcement from **Charles Fendrock** and his wife, Susan. Cecilia Winifred Fendrock was born on October 8, 1991. Thanks for the picture, Charles, she's a real cutie!

That's it for now. Keep writing.—**Jennifer Gordon**, secretary, c/o Pennie & Edmonds, 1155 Ave. of the Americas, New York, NY 10036; or 18 Montgomery Pl., Brooklyn, NY 11215

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Help us out. Please write. We need your news. From **David August**: "All is well. Marriage (one year ago) is to my liking! Here in Ann Arbor (I'm at the Univ. of Michigan Medical School), I ran into **Phil Lorang**. He is also doing well. We are members of the same synagogue!"

Fred Tsuchiya writes: "Am managing two programs at MTS, one in composite structures manufacturing, and one in testing fracturing fluids for the oil biz. Still coaching oldest (Karl, 9) in soccer and starting middle kid (Grant, 5) in hockey. I am the hockey skills clinic instructor for Grant. **Kandis (Simmons, '77)** and I also chase the youngest (Alison, 1) around to stay young."

. . . **Michele Petrofos** has "two children, Abby (5) and Patrick Harris (3). My husband, Dale Harris, and I practice family medicine in this small town (Reedsport, Ore., pop. 5,030) on the central Oregon coast. We are in the middle of the Dunes National Recreation Area. When not working, we've taken to canoeing, hiking, and biking. The kids grow and flourish on salmon and blackberries. Lately a blue heron and an egret frequent the river on which we live. Now that Abby is in school we are adjusting to having to consider one more person's schedule."

Melissa Weiksnar reports that "excitement at Synergetics continues, as we enter our fourth year. Excitement at home has included au pairs—classmates considering may call for caveats." . . . **Richard Kruger** is "currently working for General Electric in Pleasanton, Calif., as an engineer. My wife, Lisanne, is a labor lawyer, and is scheduled to go into labor herself next January (1992); it will be a girl. Recently was visited by **Jon Johnson** who was on the West Coast for a conference. He is a biology professor at U/Pittsburgh. **Al and Linda Wankel** were here last December (1990) with two of five children. **Al** is practicing surgery in Tucson, and says they may add one more to the clan before long."

Greg Saltzman writes that he "is an associate professor of economics and management at Albion College, located near Ann Arbor, Mich. . . . also have a research appointment at the University of Michigan Institute of Labor and Industrial Relations. . . . oldest son, David is just learning to walk, and his 2-year-old brother, Daniel, is just learning to negotiate. . . . have been happily married since 1979 to Andrea."

From **Roger Allison**: "My wife has returned from southwest Asia after about eight months of active duty. Hopefully next year (1992) will be closer to normal." . . . **Richard Jamison** writes, "My wife **Beverly Ross Jamison**, and I are enjoying our second year on the Educational Council. We are pleased by the quality of students applying for admission to our alma mater."

As for your secretary, I am in the midst of creating an independent sales force to market data communication services in the U.S. I have a powerful inducement in these recession ridden times—ongoing commissions. It will be interesting to see how my ideas about commodity pricing are translated into the world outside of the trading pits. I suspect that the competition is not well equipped to deal in this type of pricing environment. Everything I have seen so far indicates that the rest of the world is far more genteel than the world of futures. For we futures barbarians, the pickings look pretty good. We have a saying in

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utures business that I am trying to import into the data communications business: "We take no prisoners in the pits."—**Arthur J. Carp**, secretary, Quantalytics, Inc., 220 Henley Rd., Woodmere, NY 11598-2523, (516) 295-3632; Fax: (516) 295-3230

77 15th Reunion

Well, classmates, it's not too late to get in on the fun! Our 15th Reunion plans are well under way. To recap for those of you who may have misplaced the relevant mailings: The dates are June 4-7 at the Institute; the events include Tech Night at the Pops, the Technology Day program, a super Class of 1977 evening get-together, a reunion party with the classes of '82 and '87, and our class brunch. Much merriment, fun, distraction and good times are sure to be had. Make sure you plan to be there! As reunion treasurer, I'll also remind you that it's not too late to send in your class dues (\$15) to the Alumni/ae Association (Room 10-140) or to me if you haven't yet done so.

Speaking of reunions, **Carol Catalano Martin** would like me to pass along to you this information regarding the reunion gift. Carol continues in her role as reunion gift chair and lists the following class goals: to have over 50 percent of the class contribute to the reunion gift; to raise \$165,000 for the Class of 1977 Student Aid Fund; to increase our class median gift to \$100; and to increase the number of upgraded gifts. Carol informs us that she has a great committee to help out in this campaign—**Steve Bader, Dave Dobos, Marshall Eubanks, Paul Fallon, Leo Harten, Frank Kreimendahl, and Kevin Miller**. Another important classmate in this enterprise is **Brian Hughes**, former Count UMOC, who has established a \$25,000 challenge fund for our class. Brian has generously offered to match any classmate's increase over his/her last year gift, for gifts of \$100 or more.

Another important name in class activities is **Charlie Shooshan**, beloved president of the Class of 1977. I had the pleasure of talking with Charlie last fall about reunion preparations. He is still living in Connecticut, still flying (he now owns his own Cessna 150) and has recently opened his own private practice of general law. As of this writing, Charlie was still unsure of his availability to join us for the reunion. In his position as national chairman of the Armenian Church of America's Youth Organization, Charlie has the opportunity to be one of two U.S. representatives to an international church meeting in Moscow on the same weekend. Any of you who have alternative plans of commensurate import and excitement are certainly excused from coming to the reunion. But the rest of you are certainly expected to attend!

Now, on to the mailbags. **Christine and Christophe Berg** are pleased to announce the birth of their second child, a daughter, **Alexandra Elizabeth**, on October 4, 1991. . . . **Geoffrey A. Landis** writes from Brook Park, Ohio. Although he considers himself a somewhat "tardy member of the Class of '77," having actually finished in 1980, Geoff wanted to catch up with his latest news. Besides being a physicist working on solar energy projects at the NASA Lewis Research Center in Cleveland, he is an accomplished writer. In 1990, Geoff was awarded the Nebula Award (for the best short story of the year, given by the Science Fiction Writers of America) for his short story, "Ripples in the Dirac Sea." His first book, *Myths, Legends and True History*, a collection of stories, was recently published by Pulp House Press.

We have received word that **Steven F. Kaplan** has been appointed executive VP and member of the board of directors of AM International, Inc. in Chicago. . . . **Stephen G. Cecchetti** continues as a member of the faculty in the Department of Economics at Ohio State University and as a research associate of the National Bureau of Economic Research. He recently became a consultant

of the Federal Reserve Bank of Cleveland, and in June of this year he will begin a four-year term as editor of the *Journal of Money, Credit, and Banking*. His second son, **Ethan**, was born in September 1990, and he and his family live in Columbus.

Bob Whinnery, living in Arlington, Va., is currently working on magnetic levitation trains for Martin Marietta Corp. in Washington, D.C. . . . **Matthew Sherman** is living in Newton, Mass., and has two daughters, 3 and 6 years old. Matthew is working as assistant professor of medicine in the Dana-Farber Cancer Institute and Harvard Medical School. He is involved with basic research, clinical care, and medical student teaching in pharmacology. . . . **Esther Horwich** and her husband, **Robert Piankian**, SM '72, live in Brighton. They recently returned from a three-week vacation in Kenya and Tanzania. They had a terrific time on a photographic safari and spent several days scuba diving in the Indian Ocean.

I have notes from two physicians in Pennsylvania this issue. **Daniel Wolk** is practicing and teaching family medicine in Broomall. He is married and has two children, 2 and 5. He is active in environmental issues and the outdoors. . . . **Rick Feld** has completed residencies and board certification in both internal medicine and radiology. He is currently assistant professor of radiology at Thomas Jefferson Hospital in Philadelphia, specializing in ultrasound and CT. He was recently married to **Randi Gail Joshowitz** (BU '83).

Lastly, we hear from the California contingent. **Thomas R. Crawford** got married on April 13, 1991, to **Vilia Johnson**. Doug Johnston, '76, was his best man. At the time of his note in October, Thomas was in the process of moving to southern California from Texas to join Vilia who had gone out there ahead of him. . . . **Margaret Brandeau** and her husband, **Joseph Eschbach**, have a 2-year-old son, **John Peter**, and were expecting another son in December. Margaret is a faculty member in the Department of Industrial Engineering and Engineering Management at Stanford. She writes, "I use the math skills I learned at MIT for, among other things, analysis of AIDS screening policies for the state of California and design of manufacturing systems." . . . I hope this lengthy and informative column has left you clamoring for more and inspires you to join us for the reunion festivities in June. I know I'll be there, eager to show off my darlings, **Joia, Kellen, and Brielle**, to you that weekend. So come, one, come all!—**Ninamarie Maragioglio**, secretary/reunion treasurer, 8459 Yellow Leaf Ct., Springfield, VA 22153-2522

78

News comes to this column from the tear-offs sent along with donations to the MIT Alumni/ae Fund. Classmates are continuing their good participation in the Fund.

Scott Berger writes, "My wife Janice and I just celebrated the birth of our second daughter, **Allison**, on October 22. I am still working at Rohm and Haas after 13 years. In my current position as a research selection manager, I am involved in programs to reduce process waste and process risk." Scott and family are living in Horsham, Pa. . . . **Jaime Dornbusch** writes that last year he was named CEO and chairman of the board of Solar Suntan Products Corp., manufacturers of DeepTan and 'NO-AD' sunscreen products in Miami, Fla. . . . **Evan Klein** is living in Los Angeles and is doing consulting work primarily for small business systems.

Steve Stein writes from the north country, "I'm still working in the hospital Emergency Department in Rutland, Vt., and enjoying my house of one year (and children of three years). I can see both Killington and Pico ski areas from my living room. Any old friends up this way should look me up for a run or two down the slopes!" . . . **Drahmir "Mike" Lazar** writes, "I'm completing my last year of my tour as F-14D remanufacture

project officer at the Naval Aviation Depot in Norfolk, Va. I'm awaiting orders to go to San Diego next summer to be Pacific Fleet Air Force F-14 Class Desk. I'll have responsibility for operational readiness of AIRPAC F-14s." . . . **Carl Krasniak** is a plastic and reconstructive surgeon in Utica, N.Y. He and his wife, Lidia, have a son, Andrew. News of a second child due in December 1991 was not available at press time.—**Jim Bidigare**, secretary, 9095 North St. Rd., NW, Newark, OH 43055-9538, (614) 345-8582

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Hugh Blumenfeld has been up to quite a bit lately. "This spring I completed a PhD in poetics at NYU with a dissertation on William Blake. I justified my MIT education with a speculative chapter on how the reading of poetic images resembles a non-linear dynamic system. Somewhere between chapters four and five I put out a second album of original songs, which will be re-released on CD in a few months. When *People Magazine* said one of my love songs 'bordered on the eccentric,' I knew you all would be proud. I live in eastern Connecticut with my wife, Andrea Gaines, who's been writing subversive poems and songs about office politics since way before the Thomas hearings." . . . **Lee Parks** has been named a partner of Fried, Frank, Shriver & Jacobson. Lee joined the firm in 1984 and is a member of the corporate department, specializing in corporate and securities transactions involving complex financings for real estate and acquisitions, restructurings, and joint ventures. He has a law degree from Columbia.

Warren Manning writes, "I heard from a 'spy' that **Gerry Dyer** and **Donald Jue** were seen traveling together in Mexico wearing cowboy hats, lizard boots, and suspenders—is this true?" . . . **David Gibson** left his position as engagement manager at McKinsey to found X-Ray Optical Systems, Inc. (XOS). XOS, located in Albany, N.Y., is currently doing development work on X-ray and neutron optics for medical, material analysis, and industrial process applications. The company will be a component supplier to OEMs. David and wife Linda have five children and live in Syracuse, Ind.

Peter Standley writes, "I am still at Draper Lab in Kendall Square, where I have worked since 1980. I met my wife at Draper. We married in August 1989 and bought a house in Woburn, Mass. For any Lobby Vegetables from Baker House who remember, I still play fantasy role-playing games four or five times a month. Long Live Bippity!" . . . **David Geiser** is project group leader in the Industrial Division of Sverdrup Corp. in St. Louis. The company designs food, beverage, and pharmaceutical production facilities. At press time, David was planning a February wedding to Kitty Boevingloh. . . . **Laura (Rees) Willett** is an assistant professor and internal medicine clerkship director at Robert Wood Johnson Medical School of Rutgers University in New Jersey. Her husband, Bob Willett, is a staff physicist at AT&T Bell Labs in Murray Hill.

Daniel Jones is "still working as a contractor on an Army computer system in Taegu, Korea. Our daughter Michelle is over 2 years old, and her Korean is now much better than her father's! The work is varied and interesting, and working at a foreign site is pretty fun, at least for a while. Alas, none of the papers here cover MIT football—guess nothing is perfect." . . . **Andrew Kobayashi** announces the birth of Heather Hartman Kobayashi in August. . . . **John Becker** has been living in Santa Fe for the last two years practicing family medicine in northern New Mexico. He had a recent visit from Senior House buddy **Tom Crowley**, "the mad plasma physicist from RPI."

Daniel Weinreb and his wife, Cheryl Moreau, are the parents of Adam Thomas Weinreb, born last September 19. States Daniel objectively, "He's a little darling." . . . **Kenneth Murphy** is pleased

to have completed his Air Force obligation on July 1 of last year. He is now chief of Anesthesia Services at the North Okaloosa Medical Center in the Florida Panhandle. Says Kenneth, "Can you say Beautiful Beacher?" . . . **Mark Schwartz** was promoted to director of Product Development at Sterns Miracle-Gro Products in Port Washington, N.Y.

John Arenivar writes, "My wife Becky (Wellesley '80) gets the real plaudits. As I write this, our third child is now 12 days old. Isabel is a wonder, with thick black hair and deep blue newborn eyes. She has a 5-year-old sister and a 2-year-old brother who adore her. I am busy this year coordinating Chemistry Week activities in Cincinnati, and I'm also involved in the Regional Meeting planning of the American Chemical Society, to be held here in May. The company I work for has been in business for 75 years; I'm in the process of preparing its first patent application. Like our esteemed class secretary, I've been in community theater lately. Next August we're going to reprise a farce I had a part in on the Showboat Majestic here in Cincinnati. Hope some alums can come down to see the show!"

Naomi Pless is in her third year of family medicine residency. She is also the mother of 4-year-old Lilah and resides in Rochester, N.Y. . . . **Elaine Imoto** is a pulmonary physician at the Straub Clinic in Honolulu. She transferred last September from Kaiser in Walnut Creek, Calif. . . . **Harvey Cohn** writes, "Last May I left the security of full-time employment to pursue projects for my own clients (along with some part-time consulting work for larger architectural firms). Work has been a bit slow around here, so if anyone needs an architect—residential or commercial/institutional—please give me a call." Harvey didn't provide a phone number, but he lives in New York City in case you want to reach him.

Elaine Sears Miller had the following to say: "I've enjoyed several life changes this year, bringing many new challenges. The most joyous is the arrival of our daughter, Hannah Dorothy, born January 25, 1991. She's now crawling, climbing, and exploring everything she can get her little nose into! When I returned to work after my leave, I took a new position as technology licensing manager for Sun Microsystems. Between the new baby and new job, life is very full." Elaine and family live in Palo Alto, Calif. . . . **Becky Waring** left *MacWeek* to join a start-up magazine, *NewMedia*. "NewMedia covers multimedia computing on all platforms. I'm the managing editor. David Binnell, founder of *PC Magazine*, *Macworld*, and others, is the publisher. There are lots of alumni/ae from *The Tech* out here. I'd like to hear from others so we can have a reunion!" Becky lives in San Francisco.—That's all for this month.—**Sharon Lowenheim**, secretary, 98-30 67th Ave., Apt. 6E, Forest Hills, NY 11374

80

I am writing this column on a cold December day but hope you are enjoying the beginning of spring as you read it.

A few birth announcements this month: **Mike Benjamin** has a second child named Audrey. He reports both kids like going to frisbee games. . . . In late September, **Jeffrey Jaycox** and wife Karen had their second child also. Colette joins Brendan, 2. Jeffrey is working as a sales rep for Cadeuce, an electronics design automation firm in the Washington, D.C., area. . . . By the time you read this **Matthew Steele** and wife Randi will have celebrated the first birthday of their second child, Norman Charles. Both of them are still working at Texaco in Houston. Matthew is in the finance department. . . . **Arthur Hu** and his wife Jenny had a son, Eric, born on Labor Day. They live in Mountain View, Calif., where Arthur works for Ashlor doing Windows CAD. He also writes a weekly column in the San Francisco-based *Asian Week*.

Mark Zaretsky is working on color copier tech-

nology for Kodak. Mark and his wife Judy are enjoying home ownership in Rochester, N.Y. . . .

J. Mark Karlen has left the faculty of the University of South Alabama Medical School to enter private practice of anesthesiology in Dallas, Tex. . . . **San Yuan** and **Wendy Huang Yuan** have settled in Walnut Creek near San Francisco. San is an anesthesiologist in private practice. Wendy left her finance position at Hewlett Packard to stay at home with their children, Neal, 3, and Sandy, 1.

Tom Vasicek is doing postdoctoral research in embryology at Princeton University. While rowing with the Carnegie Lake Rowing Association he ran into **John Stenard** (who has been promoted to LCDR). Tom's rowing took him to the Head of the Charles in October. He is getting married next fall to Teresa Lavoie. . . . **John Kevin Wojahn** is still in the Air Force working as an F-16 instructor pilot. He is stationed in Frankfurt, Germany.

That's it for this month. I hope to hear from more of you. Send your news to: **Kim Zaugg**, secretary, 2384 Leslie Circle, Ann Arbor, MI 48105, (313) 665-2365, vayda@erim.org.

81

There's a little more news than average this month, including some very busy times for the stork, so let's have a look:

Infanticipating. . . . **Carl C. Awh** and his wife of five years, Grace (Wellesley, '82), are expecting a new addition to the family some time in April, to join their son Robert. Carl will complete his fellowship in vitreo-retinal surgery at the Duke University Eye Center this June, then hopes to take a position at an academic department of ophthalmology and continue his research on diabetic retinopathy and microsurgical instrument development. Says Carl, "At last I can clearly see the light at the end of the tunnel." Pun intended. . . . From Carl we also learn that **Tim Peters** and his wife, Jessalyn, and **Patrick Hynes** and his wife, Meghan, are also on the way to becoming proud parents. One can only imagine the conversations!

Special deliveries. . . . **D. Scott Davis, Jr.** and his wife, Courtenay, inform us of a new daughter, Stacy, joining their three-year-old daughter, Lauren. The happy family has now moved back to Dallas after seven years in the Boston area, and are glad to be back. Scott is still with the One Source (CD-ROM) Division of Lotus Development Corp., as an account support representative in the Lotus Dallas sales office. . . . **Mark Niemer** and his wife, Yasyn Lee, had their first daughter, Elizabeth Caryn, last July. Mark is now busily engaged in private practice in rheumatology in Minneapolis. . . . **B.J. Messenger-Rapport** and her husband, Ken, are the proud parents of a new son, Jacob, also born last July. Their three-year-old, Nathan, is proud of his new status, and lets everyone know that he's the big brother.

Get your kicks. . . . **Don Jones** and his wife Ruth (Wellesley, '81, Sloan, '87) just can't get enough of playing soccer. They're playing in no fewer than three co-ed(!) soccer leagues, two indoor and one outdoor. In his spare time, Don works for LeBlond Makino Machine Tool Co., selling metal cutting flexible manufacturing cells ("high tech rules!" says Don). Don also reports that he has a rather unusual dog, a 105-pound Great Pyrenean Mountain Dog named Rigel, who everyone seems to like (at least those who meet him with the lights on, I presume).

New title. . . . **Eugenia Long** has made a change in state, from budget director, Boston Department of Public Welfare to director of budget and planning, Brandeis University. . . . **Yes, icon!** . . . **James Hancock** informs us that he is the manager of consulting services at Eikon Systems, Inc., a small software company in Foster City, Calif., specializing in the development of applications and utilities for Microsoft Windows.

Finally, I regret to report the passing of **Gregory Tomlinson** last November, of lymphoma.

At the time of his decease, Gregory was the manager of business planning and demand-side management for Boston Gas Co., where he had worked since he received a master's degree in business administration from Boston University in 1983. He was chairman of New England Gas Evaluation and Monitoring Study and a member of the International Association for Energy Economics. Gregory often testified on behalf of Boston Gas before the Massachusetts Energy Facility and Siting Council. He shall be missed by his classmates.

Well, that's an EOT for this month.—**Mike Gerardi**, secretary, 1515 S. Flagler Dr., #1204, West Palm Beach, FL 33401

82 10th Reunion

Please send news for this column to: **Stephanie Pollack**, secretary, 25 Royce Rd., Newton, MA 02159

83

Every so often your class secretary gets lucky. The MIT folder was reasonably thick this month. Here's the scoop: The first thing in the folder was a black-and-white glossy photo of a classmate. For those of you who are not so experienced with class secretary lore, this is a certain indication that someone has joined a really big company—you know, the kind that is so big that they have a person whose sole job is to send glossy photos and press releases to alma maters, etc. Dr. **Pierino Bonanni** is the lucky beneficiary. He recently joined the GE Research and Development Center as an electrical engineer, concerning himself with applications of signal and image processing techniques to control problems. Previously, Pierino worked at Fonar and IBM. The picture will be awarded to the first classmate who sends a self-addressed stamped envelope and can correctly locate the whereabouts of **Alex Petofi**.

The following people sent in money and wrote down what they are doing (and therefore should be doubly congratulated). . . . **Pete Fader** is still toiling away in the marketing department at Wharton. He comes up for tenure next fall. Pete's wife, **Mina Park Fader** ('85), is climbing the corporate ladder in the Chemical Products Group of FMC. She is now assistant controller and claims it's just another rung or so to CEO. . . . **John Thompson** and **Shair Strothers** ('84) are expecting their second child this April. Their first child, **Paraoh Martin Delaney Thompson**, is already proficient at keyboards and drums. . . . **Marilee Lyle Andrew** married **Rex Andrew** in July and they are living in Victoria, B.C. Marilee has spent the last 7.5 (her notation, not mine) years working as an acoustic analyst for the Naval Undersea Warfare Engineering Station in Washington State as branch head of acoustics analysis. During this time she also earned a master's in acoustics through Penn State via satellite. Marilee is now considering an entrepreneurial career and welcomes advice from classmates. You can reach her at 1492 Edgemont Dr., Victoria, B.C., V8N 4P8 Canada.

Brenda McDonough Anderson recently took a year off for an undisclosed "fun" time. She has now returned to General Atomics and is working on fusion energy research. . . . **Pace Willisson** and **Wendy Rowe** write that they are now living in Medway, Mass., and have a lot more space than they did in Somerville. The new addition to the family is son **Alex**, born September 5. Brother **Eric** is now 2. **Pace** works for his own computer consulting company, **Blitz Product Development Corp.** Wendy says she helps him out at **Blitz**, but the kids are keeping her pretty busy right now. . . . **Cindy Pribble** writes that she and **Greg Kochanski** ('82) continue to live in New Jersey. She works for a division of **Bristol-Myers-Squibb** and **Greg** is still at **Bell Labs**. They have not been able to do much flying lately as they are repaint-

ing the plane. Come spring they plan to start on their IFR ratings.

John Harris writes that he just received a PhD in Computational and Neural Systems at Caltech. He is now doing postdoctoral research at the MIT AI Lab. . . . **Michelle Gaudreault** writes that she and **Pierre** are expecting their second child in June. She hopes to have completed her doctorate by then. You can reach Michelle in Beavercreek, Ohio. . . . **Cynthia Bedeu** is back at MIT for a master's in material science. She is supposed to finish in '93 and then join the faculty at West Point. Cynthia is still a captain and, with the drawdown, expects to be a captain for quite a while longer (would someone please write and tell me what that means). . . . **Roland Ouellette** recently visited Washington, D.C., and ran the Marine Corps Marathon with **Peter Tzanetos** ('85) and **Kevin Ray** ('88). . . . **Dr. Michael Isnardi** was promoted to head, Systems Research Group, at the David Sarnoff Research Center in Princeton, N.J. Michael helped develop the Advanced Compatible Television System, which was tested by the FCC from last July to September. It is one of six candidate systems for the next U.S. TV standard.

Betsy Pollack married **Howard Benjamin** ('82) in September. The wedding was attended by **Burton House** alumni **Paige Kolz**, **Dave Payne**, and **Annette Hulse** from California, **Steve Janowsky** from New Jersey, **Naomi (Kagetsu) Bukowski** from Michigan, **Sara Henderson** from Pennsylvania, **Sue (Strausman) Rietti** from New York, and locals **Joyce Kelly**, **Jennifer Hance**, **Russ Murphy**, **Susannah Wurgler**, **Eric Alani**, **Nelson Ronkin**, and **Matthew Stern**. . . . **Alan Taylor** and wife **Leslie** have moved to Boulder, Colo. Alan graduated first in his class at Berkeley Business School and is now working in an energy consulting firm. Leslie is an accomplished portrait artist. . . . Last but not least, future senator **John Piotti** wrote a Christmas card indicating that he and wife **Susan** are taking off to see the world in '92. They'll start in Europe in January, and then it's on to points unknown. We expect to report more on this escapade in the future. The odds-on favorite is that John will begin serving as ambassador to one of the new Soviet republics.—**Jonathan Goldstein**, secretary, TA Associates, 45 Milk St., Boston, MA 02109

84

Karen Covert, '86, recently attended two **Burton House** weddings: **Layne Yamada** married **Lori Ann Michiko** in Hawaii and **Patrick Tan** married **Sean McCarthy**. . . . **Annette Hulse** finished a master's in chemical engineering at Stanford and is happily back consulting in energy and environmental sciences. Annette and husband **Dave Payne**, '83, live in Santa Clara with their son **Scott**, 4.

Tony Riccobono took advantage of the real estate market slump and bought a townhouse in Redondo Beach. House and owner survived an awesome house warming party. . . . **Doremy Tong** recently moved to Fruit Heights, Utah, and is working for SAIC. . . . **Ralph Siegel** married **Susan Lovich**, '85. They live in New York where Susan is finishing a residency in pediatrics.

After traveling for over two years with girl friend **June Gesell**, **Bill Larkins** and **June** found jobs, got an apartment and eloped in the span of a month. They live and work in Manchester, N.H.; Bill is at **Deka** designing medical instruments and **June** teaches high school. . . . **Hauke Kite-Powell** has been working on a PhD in the Ocean Systems Management Program at MIT while working as a research assistant at the Marine Policy Center at Woods Hole. Hauke will marry **Soo Sheung Wong**, Sloan '91, next month and, if all goes according to plans, graduation will be the day after the wedding. This will conclude 12 years of (on and off) studenting at MIT.

Bruce Kinzinger is now in Baltimore half way through a three-year residency program in family

medicine. Bruce's long-term interests are directed toward teaching and public health service work. Meanwhile, he enjoys sailing on the Chesapeake Bay during free hours of warmth and wind. . . . **Lincoln Greenhill** has one more year to go as a Miller Post-Doc Fellow in the astronomy dept. at UC Berkeley. Lincoln voices a typical California complaint; he misses the seasons and also points out that skiing is tough during drought seasons.

Joan O'Connell is back in Cambridge and in this soft housing market and low interest rate climate she is looking to buy a house. Joan has dinner every-so-often with a local crowd of E Thetans. . . . **Audrey Dow** is student teaching at Newton South H.S. In June she will receive an EdM from Harvard Graduate School of Education and will have teaching certification for secondary chemistry and physics. Audrey is enjoying the career change from engineering to teaching and likes grad school at the little red schoolhouse!

Soma Chaudhuri just started a tenure-track faculty position in computer science at Iowa State. Her husband is still an assistant professor at the Univ. of North Carolina, Chapel Hill. Unfortunately, neither is a physicist and so they have been unable to solve the two-body problem. . . . **Mark Skinner** is back from a year and a half on Maui running an observatory. He returned to Wisconsin, wrote his thesis, got a PhD in physics, took a post-doc in Madison, and has now taken a job on the research faculty at Penn State. Mark is working on a cosmic x-ray project to be launched in conjunction with Argentina's SAC-B.

Ron Rubenstein (who I have never met and, thanks to my alternate spelling of our last name, who I have never been confused with) graduated from the Univ. of Texas Southwestern Medical School and the School of Biomedical Science with both an MD and PhD in pharmacology. He is doing a residency in pediatrics at Children's Hospital in Pittsburgh and is happy to be back in the Northeast.—**Howard Rubenstein**, secretary doctor, 28 Mitchell Grant Way, Bedford, MA 01730, (617) 275-0213 (home), hbr@mitre.org.

85

Please send news for this column to: **Bill Messner**, secretary, 520 Key Blvd., Richmond, CA 94805, internet: messner%cmldsf@ucbarpa.berkeley.edu

86

Jerrard Sheehan started working in September as an analyst at the Congressional Office of Technology Assessment. He is currently in the industry, technology, and employment program researching competitive issues associated with a U.S.-Mexico free trade agreement. . . . **John Bartholomew** is enjoying his four-month old son, **Dylan**, who was born in July. He and his wife, **Kim**, who live in Oregon, had a fun weekend visit from **Jon "Sid" Fearnside**, '87, from Seattle. Also, at Thanksgiving, they received **Paul Boutin**, '85, from San Francisco. They will be spending their holidays on the East Coast where they hope to see more friends while in Boston.

Susan Visser received a PhD in chemical engineering from the Univ. of Wisconsin-Madison in May 1991. She is currently working at **Kodak Research Labs** in Rochester, N.Y. . . . **Vic Christensen** is still at **Wright-Patterson AFB** in Ohio, working as the F-22 SPO Computer Security Officer. . . . **Edison Wong** will complete his internal medicine internship at **Maine Medical Center** in June 1992. He'll then begin a three-year residency at the Univ. of Washington in physical medicine and rehabilitation. . . . **Paul Huang** and **Grace (Chen) Huang** have been living in Tokyo, Japan since October 1990. In February 1990, Paul took the PhD entrance exam for the Univ. of Tokyo and passed. In April 1990, he enrolled as a PhD candidate in electrical engineering. He hopes to receive his degree in three years. While Paul is busy doing research in telecommunications,

Grace is spending all her time studying Japanese, understanding Japanese culture, society, and business conditions. She plans to begin working in a Japanese company in the coming year.

Craig German is working with Karl Buttner, '87, Erich Orenchuk, '87, Rakesh Shukla, '88, and Dan Kennedy, '87, in the hottest new software company: 170 Systems. If you need document imaging systems or products, they're the ones to call. They're located across from the Cambridge Side Galleria, within walking distance from the world of food courts. . . . **John Campbell** is attending medical school at Pitt.

Kevin Talley will be graduating from the AF Institute of Technology in January 1992. He will be starting an intelligence job at the Foreign Technology Division at Wright-Patterson AFB. . . . **Ramon I. San Pedro** and Sylvia Perez are happy to announce the birth of their daughter, Alyssa, on July 1, 1991, in Houston, Tex. . . . **Peter Tu** is in his first year of law school (as the Whipple Memorial Scholar, which provides a full-tuition scholarship).

Tom Kurfess has started his third year in Pittsburgh where he is a professor of mechanical engineering at CMU. He lives with his wife, Adriana (Praddaude), '87, on the CMU campus as faculty in residence. . . . **Donna Giesman** received a PhD in genetics in May 1991 from UPenn. In July 1991, she married Eugene Cookmeyer II. She has accepted a postdoctoral position in plant virology at NC State in the Department of Plant Pathology. . . . **Karen Covert** bought a townhouse in Arlington, Mass. She is still working for Information Resources where she's been for four years.

Dan Harasty announced the birth of his first child, Joshua, on August 28. As Dan puts it: "A new macro-atomic particle was identified at Kimball Medical Center in Lakewood, N.J., at 10:58 a.m. Dubbed the 'Joshua' particle, it was produced by the spontaneous fission of the heavy Susan particle, an isotope with a half-life of about nine months. The free energy of the reaction is several Bev (baby electron volts). This typically takes the form of acoustic vibration. Although little is known about the long-term characteristics of the Joshua particle, it weighs 9 pounds, 6 ounces, has a non-relativistic length of 22 inches and has positive spin. It also seems to be a strong breast milk acceptor. "Co-discoverers Dan and Susan Harasty are both well, overwhelmed, overjoyed, and tired.

Speaking of babies, **Carolyn (Beer) Zerkle** had a baby girl, Sandy, earlier this year. . . . I also hear **Karl Tucker** is doing fine at Harvard Business School. . . . **Anne Fricker** ran into him at Harvard Square. If you get a chance, Karl, drop me a line with your address and phone number.

Well, that's all for this month.—**Mary C. Engbreth**, secretary, 1805 Manhattan Ave., Hermosa Beach, CA 90254, (310) 376-8094

87 5th Reunion

I'm not quite sure what happened last month, but it seems like the Class of '87 has decided to spill the beans. . . . not a moment too soon! Here's some of the information that was sent in to the *Technology Review* office.

Hillary Thompson is now living in Menlo Park, Calif., and is continuing her studies at Stanford's Department of Applied Earth Sciences toward an advanced degree in geochemistry. . . . **Nike Agman** moved to New Haven, Conn., last summer after receiving an SM in chemistry from U.C. Berkeley in 1990. He is now attending the Yale University PhD program in Slavic linguistics. That's quite a change! Good luck!

Gabe Cole wrote: "My wife, Linda (Maccini) Cole (Wellesley '87), and I have been living in Cambridge for the past year. I am working for Simpson Gumpertz & Heger, an engineering consulting firm in Arlington, Mass., and completing a master's degree at MIT. This year I assumed duties as Phi Beta Epsilon reunion chair along

with **Mike Sheldon**. We held the '91 reunion in Mystic, Conn. Notable visitor was Matthew Wall, '89, who cycled from Cambridge to Mystic (seven hours). Matt is still at MIT, has just completed the LFM (Leadership for Manufacturing Program), and is now working on a PhD in mechanical engineering. Although they did not attend the reunion, I also heard from **Alex Cohen** and **Kris Grube**. Alex is back in his home state of Kentucky working on a new product line. Kris is working for a start-up firm in Austin on prototype technology and commuting to New Haven, where his wife Cindy is attending Yale Law School. Fortunately, Kris is now collaborating on a project with a firm in Cambridge, so his commute has been reduced."

After graduating from Columbia Law School in 1990, **Michael Haungs** worked as a law clerk for one year on the U.S. Court of Appeals for the Federal Circuit. He is now working as an attorney with the Justice Department in Washington, D.C. . . . After two and a half years at Fort Leonard Wood, Mo., **Andrew Sterbenz** is finally moving to an Army division. Andrew graduated from the Engineer Officer's Advanced Course on October 10, 1991, and is now serving with the 24th Infantry Division in Fort Stewart, Ga. His wife, Toni, is already there serving with the 92nd Engineer Battalion. "Essayons!" . . . After a hectic summer taking Georgia teacher certification courses, **Coleen V. (Barry) Smith** is now a high school math teacher. Her husband Doug ('86) is working as a process engineer for Hercules in nearby Brunswick. Both enjoy living on a warm, semi-tropical, beach-surrounded island.

Mike Cuffe received an MD in June 1991 and began an internal medicine residency at Duke. . . . **Hina Chaudry** is also in Internal Medicine at Duke. . . . **Jack Leifer** received an SM in mechanical engineering from the University of Texas at Austin in August 1989. He recently passed his oral qualifiers for a PhD in mechanical engineering at the University of Texas. . . . After graduating from Sloan in June, **Stephen Murphy** accepted a position with Merck & Co. as a professional representative managing a territory in Worcester, Mass. Stephen and wife Alexis moved in January to an apartment in Newton in which Alexis has established a successful family daycare business.

Thomas Hoffman is in his second year at Harvard Business School and is captain of the Business School soccer team. Over the summer, Tom consulted for a small company in Greenwich, Conn. . . . **Bryan Moser** writes: "Following one year of research in Neural Networks at Nissan Motor Co. in Yokohama, I joined United Technologies in Tokyo as assistant to the president for technology policy. While working with the R&D infrastructure in Japan, I am pursuing interests in neural-fuzzy logic approaches to design and decision optimization. I meet with other MIT grads in Japan often, including **Guillaume Ambuzzo** and **Nat/Joyce Palmer-Fortune** ('89).

Adriana (Praddaude) Kurfess writes: "Tom ('86) and I have started our third year in Pittsburgh. Tom's a professor of mechanical engineering at Carnegie-Mellon University and I just started teaching seventh- and eighth-grade science and math. It was quite a switch from mechanical engineering, but I absolutely love teaching. Pittsburgh is great, too. We live on the Carnegie-Mellon University campus as faculty residents, which is a blast!" . . . **Stephen Berczuk** is living in Arlington, Mass., and working for Eastman Kodak's Boston Technology Center in Billerica, Mass. Stephen is engaged to be married sometime next fall. Congratulations! . . . **Bridget Fitzpatrick** is an educational counselor in Kingsville, Tex. and working for Hoechst Celanese as the facility energy coordinator in the Utilities Department.

After graduation, **Ojas Rege** worked as a product line manager at Oracle for three years. In September he started an MBA at Stanford. Ojas writes that **Chris Lerch** is working for Lockheed in Los Angeles, **Bruce Davis** is doing a PhD in

Aero/Astro at the University of Texas at Austin, **Jerry Cline** is doing a physics PhD at Cornell, and **Sundee Manocha** is getting an MBA at Cornell.

And now, some information which came directly to me. . . . **Betsy Parker** writes: "By the time this gets into *Technology Review*, I will be more than halfway through my one-year master's in education at Harvard. I decided that four years of chemical engineering was enough, and now it's time to teach would-be MIT students. I'll be student teaching two science classes in the spring at Newton North High School.

"Although I miss Chicago, it's nice to be back in Boston. I've been trying to see fellow classmates **Linda Marinilli** and **Linda Chao** on a somewhat regular basis, but, with me and Linda being students again, it's hard to arrange!

"I'm looking forward to our reunion weekend, especially seeing fellow FWFs from McCormick!

Stacy Weinstein sure seems to be enjoying California! She is still at JPL in Pasadena (along with Grace Tan, '86, and scores of other MIT alumni) and doing all kinds of advanced studies—Neptune Orbiters, Pluto Orbiters and Flybys, asteroid missions—as well as trying her hand at management. Stacy says that it's pretty interesting work and the sailing is great, too! . . . Stacy saw **Lalita Jategaonkar** last June when she was in California for a conference. Lalita also traveled to Paris recently and is now finishing a PhD. . . . And for all of you who are into underground music, Stacy suggests you check out Screams for Tina. If anyone wants to get in touch with Stacy, her e-mail address is stacy@iji.jpl.nasa.gov.

Keep up the great work. Please call, write, fax, or e-mail me with the latest news that's fit to print! (I'll make exceptions if it's really good.)—**Stephanie Levin**, secretary, 159 W. 80th St., Apt. 1D, New York, NY 10024, (212) 595-3172, fax: (212) 983-9107, e-mail: mikki.mitvms.mit.edu

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Greetings everyone! I've received a bit of Lamda Chi gossip. **John Ramsey** married Lea Montefalcon (Stanford). Included in the wedding party were **Steve McLaughlin** and **Tim Mattox** (groomsmen) and **Paul Laporte** (best man). **Dave Evans** and **Kelly O'Neil** attended along with many others. It sounds like a good time was had by all. Steve has started a company, Fitness Experts in Sarasota, Fla., and says to drop by if you're ever in the area. Kelly is enjoying her involvement in space technology development at Lincoln Labs.

Belated congratulations are also in order for **Haqni Asfour** who married Rula Nasrallah in May 1990 in Paphos, Cyprus. Rula is currently looking for a job in computer engineering in the Boston area. Hani is attending Harvard Graduate School of Design and hopes to graduate in December 1993.

Salvatore Rubino is a senior trader for Societe Generale (a French banking company) in Philadelphia. He is involved in trading foreign currency options on the Philadelphia Stock Exchange. . . . **Chris Sklarin** is working in Wakefield, Mass., for Boston Technology. He worked for nine months at the Christa McAuliffe Planetarium in Concord, N.H. He highly recommends a visit if anyone is in the area. . . . **Thomas Spitznagel** is finishing up PhD work in chemical engineering at UC Berkeley. . . .

Michael Donohoe is currently residing in Simsbury, Conn. He is participating in an operations management development program at UTC/Hamilton Standard. **Lily Huang** is attending Wharton Business School and enjoying herself. . . . **Karen Wu** is a fourth year student at Columbia Medical School.

Greer Tan is at a new job with Xerox Imaging Systems and she loves it. She and Rob are planning a June wedding and are busy settling into their new home. They were recently in Washing-

Solar Car Update: The Latest Word from Worden

If racing solar cars is fun, winning is even better. But James Worden, '89, who has been called "the Henry Ford of solar cars," is setting his sights on a more elusive prize. After racking up numerous victories—most recently with first-place finishes in the American Tour de Sol in May and the California Clean Air Race in July—Worden is intent on building a practical commuter car that people actually want to buy.

The vehicle, so to speak, for his vehicle is the Waltham, Mass.-based Solectria Corp. that Worden started in 1989. Anita Rajan, '90—another engineering graduate and racing enthusiast—is the company president. The car they're marketing, the Force, is a Geo Metro that has been converted to run on lead-acid batteries powered by sunlight or electricity from standard outlets. The two-seat version of the Force, which sells for about \$25,000, can travel up to 120 miles; the four-seat model can go up to 80 miles.

Solectria put the Force on the market in May 1991 and sold eight by the end of the year. The company hopes to deliver about 50 vehicles in 1992. Solectria has also built two cars from scratch—the Flash and Lightspeed—that exceed the Force in terms of both range and acceleration. Lightspeed, for instance, can travel 150 miles before needing a recharge.

Worden maintains that the Force is already practical for commuters—a statement backed up by five years of continuous, on-road experience. In fact, he and Rajan drive their Force to work together, seven miles each day from Arlington to Waltham. It's cheaper to operate and maintain than a standard 50-mile-per-gallon Geo Metro, he says, although the initial purchase price is quite a bit higher. That cost should come down considerably when Solectria scales up production. Right now, cars are made one at a time, but the company will soon be able to make 10 cars at once. By 1997, Worden hopes to have an assembly line cranking out 20 Forces (or its more advanced progeny) a week.



His own personal Force has a photovoltaic panel (or solar cells) mounted on the roof that provides it with the extra power to go eight "free" miles—more than enough to take Rajan and him home from work after the car sits in the sun all day. At night, the car's battery pack is recharged by plugging it into an electric socket.

Worden looks forward to a time when sunlight will supply all of a car's energy needs. For instance, solar panels at the workplace might charge up cars parked during the day, while panels installed on the garage at home charged storage batteries. At night, these batteries could recharge the car again. On a grander scale, solar electricity generated in the desert or wind-generated electricity captured in the Great Plains might be fed into the power grid and distributed throughout the country.

"Those are the pollution-free ways to go," Worden says. But even if the electricity comes entirely from coal-fired power plants, electric cars would still generate far less pollution than a gasoline car. Worden estimates that carbon dioxide emissions, of vital concern for global warming, would be cut in half owing to the superior efficiency of his vehicles.

It's not surprising that environmentally conscious people are Solectria's main customers. And the whole movement will receive a big push in 1998, when California requires that two percent of the new cars sold be emission-free. Electric vehicles offer the best hope of meeting that goal.

By then, some of the big automakers like General Motors may have entered the arena. "They won't make this kind of car unless they really have to," says Worden. "These companies are moving slowly because they have so much money invested in the present system and are so closely tied to the oil companies."

Of course, a sudden jump in the price of oil would change the whole picture dramatically. But, says Worden, "I hope that doesn't happen until we're ready to accommodate the demand." —Steve Nadis □

ton, D.C., for the National Republican Heritage Group Council Convention. She met Wayne Budd as well as many other interesting people. Her most memorable experience was at the Cirque de Soleil which was showing outside of Capitol Hill.

Kevin Foote has acquired wanderlust after making a solo traverse across Lapland, Sweden, with a mountain bike. This experience caused him to quit his management consulting at Braxton Associates and travel the world. He is presently in an international project management training program with GE and hopes to begin traveling to remote areas building power stations and installing gas turbines.

David Espinosa is selling all his musical equipment to help feed the homeless in New York City. That is certainly very admirable. . . . **Burl Amsbury** is flying A-6E Intruders out of Whidbey Island, Wash.

Much thanks goes to **Chad Raymond** who drops a line from the San Francisco Bay area. He claims life is great: "fun, sun, motorcycle gangs, and no yuppies." His new-found hobby is shark fishing. He heard from **Martin Scheidl** who has ended his bakery venture due to the recession. Marty is currently working for a management consulting firm on a project for the District of Columbia's public works department; something to do with modernizing the sewage system. Chad visited **Dave** and **Michelle Glassner** in L.A. over the Labor Day weekend. Dave is still working on a PhD in physics at USC. Michelle divides her time between being a manager at the L.A. Hilton and booking performers for Caesar's Palace in Las Vegas.

Rod Hinman is still living in East Cambridge, completing doctoral studies at MIT. His wife, Shannon, has started veterinary school at Tufts. Rod says he often eats dinner away from home because Shannon does her anatomy homework on the kitchen table. Rod ran into **Mike Russell** in Lobby 10. Mike was in town after taking a pleasure trip to the Philippines as a break from his graduate studies at Cornell. The highlight of the trip was an escorted tour of Mount Penitubo after the eruption. . . . **Evan Hansen** has returned to Boston to form another rock band after completing his SETI research in New Mexico. He plays guitar.

Seth Brown will marry Marya Lieberman, '89, in June in Seattle. . . . **Michael Gaidis** and his wife, Denise, are expecting their first child in July. Congratulations to all! Michael is keeping busy at Yale with Al Rizzi, '87—both playing lacrosse on the New Haven Club team. Thanks to all who wrote!—**Grace Ma**, secretary, 545 First Ave., #7R, New York, NY 10016, (212) 447-1925

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Happy New Year everyone! It's been a pretty decent year for our class notes, but please keep in touch by sending cards or email this year also!

Richard Rainey has started law school at George Washington University in D.C. after working for two years for Andersen Consulting in New Jersey. Richard plans to focus on intellectual property law or environmental law. Richard would like to announce that he and his wife had their first baby on August 8, 1991, a girl named Sara. . . . **William Jacobs** finished a master's in aero and astro from Perdue in May 1991. William is now working on his doctorate in economics and finance at the University of Toronto. . . . **Michael Friedman** just moved back to Boston, and is now working for Oracle Data Publishing. **Andre Castagna** is pursuing a PhD in aero at Rensselaer Polytechnic Institute.

Marya Lieberman and **Seth Brown**, '88, will marry in June in Seattle. . . . **Michelle Sequeira** is working for Ethicon, Inc., and is living in Albuquerque. . . . **Michelle** and **Mike Westphal**, '90, attended the wedding of Bonnie (Scurlock) Steele, '90, and Alan Steel, '91, in Seattle, where she also saw **Jennifer Felch**. Also attending the

wedding were **John Olson**, Kevin Byrd, '90, Rachel Batcheler, '91, John Reardon, '90, Topher Heigham, '81, and his fiancée, Lynn.

David Campbell has been spending most of his time diving and surfing in Puerto Rico with the U.S. Navy.

Jeffrey Hornstein is a PhD student at the University of Pennsylvania. His dissertation research in comparative politics will compare the nature of democratic movements in Czechoslovakia and Russia.

Wilson Wong graduated last May from Cornell's business school and is starting work as director of MIS at his company in Long Island.

Lori Tsuruda is at Tufts and is now divorced.

... **Ed Kim** left his job at Prudential Securities in November and moved to San Francisco to be an associate in the Equity Research Department of Robertson, Stephens & Co., a private investment bank. Ed writes, "I never thought I'd be so eager to leave New York, but I think this is a great opportunity to try something a little different." Ed's area of focus will be biotechnology companies, particularly those involved in the study of autoimmune diseases and cancer.

Christy Alvord returned from London during the Christmas holiday. Christy, who was supposed to have been in London for "three weeks, maybe a bit longer," ended up staying six months at the London office of McKinsey. ... **Mark LuBratt** turned in his thesis in September and is now working at 3M in Minneapolis. He's in the Advanced Diskette Technology Group, and will be heading to Oklahoma for a few months to help get a new product into production. Mark also saw **Alice Biber** and **Charlotte Biber** in Zurich, who are involved in ice hockey there. Alice and Charlotte recently tried out for the Swiss National team. They have also been trying to arrange a scrimmage with the German team which Julie Ask, '90, is playing for.

Jason Nieh was home in Illinois for the holidays. Jason injured his ankle last fall, and is nursing it so he can ski in January. ... **Shirley Chang** is getting married on September 12, 1992, in Northboro. She and her fiancé, Scott, met at GE in Cleveland where both of them worked. ...

Scott Deering is getting married in Boston on July 11, 1992, to Michelle Fearon, a Brown University graduate. They will honeymoon in Jamaica. Afterward, they will be return to Next House where Scott is currently a floor tutor and graduate student in materials engineering. Scott is still in track and field and training to compete in the U.S. Olympic Trials in New Orleans this June. He hopes to get on the three man hammer throw team going to Barcelona, Spain, for the 1992 Olympic Games. "In other news, plans are proceeding for the CC Reunion Jam, which will probably be held next spring. All interested CC alums and friends can contact me for more info. My twin, **Eric Deering**, is attending Wharton Business School in Philadelphia and going after an MBA."

Rumors about **John Buck** working in LCS or the AI Lab were "greatly exaggerated. Well, not that greatly," John writes. "I'm actually in area 3 in Research Lab of Electronics, just now starting on a PhD in the MIT/Woods Hole Oceanographic Institution joint program. I finished a master's in the same program in August. Along the way I enjoyed working in WHOI's marine mammals lab this past summer, including an eight day research cruise in the Bahamas." John presented some of last summer's work at a conference in Chicago. He lives in a house in North Cambridge, along with Kirk Johnson, '88, Dan Schmidt, '91, Doug Church, '90, Tim Stellmach, '90, James Fleming, '90, Nick Carter, '91, Jon Maiara, '92, and a few other guys. "The place hasn't collapsed around our ears yet," John reports.

I'll be taking my oral exams soon, so I'm back here at MIT during IAP studying. Please send news, and best wishes to everyone in 1992!—**Henry Houh**, secretary, 4 Ames St., Cambridge, MA 02142, (617) 225-6680, e-mail: tripleh@athena.mit.edu or henry_houh@mit.edu

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Anita Rajan writes that she and James Worden ('89) are keeping busy working at Solectria, the company they founded two years ago to research, develop, and manufacture electric cars. Anita serves as Solectria's president and James is the CEO and director of R&D. In April 1991, they raced their production car, the Force, in the Solar and Electric 500 in Phoenix. Rick Franklin ('89) met Anita and James at the track and helped them come in second in the grueling race. Over the summer, the California Air Resources Board did some efficiency testing of the Force and reported that it had "the most impressive range and performance of any currently available production electrical vehicle of which the Air Resources Board is aware." In May, Solectria was in yet another race! The Force was entered in the third annual American Tour de Sol, a road rally from Albany, N.Y., to Plymouth, Mass. Solectria's cars won first and second place against 30 competitors. The race featured solar and electric cars built by companies, universities, high schools, and individuals. Congratulations to Solectria!

George Nunn is working in London as a trader with Banque Paribas Capital Markets in the Swaps and Options Department. ... **Elisabeth Stock** is serving her second year in the U.S. Peace Corps in Ghana. She's busy teaching physics and math to secondary students and would love to hear from classmates! Her address is Juasa Day School, P.O. Box 14, Juaso, Ghana, West Africa.

John Mruz is working for General Electric in Utica, N.Y., and going to RPI part-time for a master's in electrical engineering. He's participating in the Edison Engineering Program and Advanced Course in Engineering at General Electric, Utica. ... **Kathryn Viksne** is stationed at Tyndall Air Force Base in Panama City, Fla., as a weapons controller.

What's up with everyone else? Please send news.—**Ning Peng**, secretary, 355 S. End Ave., #27G, New York, NY 10280, (212) 745-2704 (w)

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"Howdy classmates," writes **Michael Mitchell**, "I'm working at IBM in Rochester, Minn., in a multimedia technology group and having fun. Rick Buellesbach, '90, and I are teaching these other midwesterners that even the City of Healing can't recover from a night of partying with the Kappa Sigs. Hello also to the alumni/ae of the Festival Jazz Ensemble!"

Lee Heavner writes that he is working for Economic Analysis Corp. in Los Angeles. ... Both **Jeff Drake** and **Derek Rutherford** attended the Engineer Officer Basic Course for the U.S. Army. Derek looks forward to his move "from the middle of nowhere" in Missouri to Fort Stewart, near Savannah. In March, he'll join the 24th Infantry Division in Georgia. ... **Arlene Yang** is at the New York University School of Law and finds it more interesting than she expected. She has seen **Mikyung Kwah**, who is studying at NYU's medical school.

David Haley writes that he is "having a blast" living in Houston. "It's as hot as they say, but we learned to deal with it." He hopes the 9-to-5 scene isn't too tough for anyone. ... **Sharon Marcadis** is a chassis design engineer at Nissan Research and Development in Michigan. She is currently working with steering systems. ... **Eric Nudelman** is training to become a field engineer for Schlumberger Wireline and Testing International. He studied in Comodoro Rivadavia, Argentina, before moving to another South American site in January.

Andrew Alleman is working on a master's in electrical engineering at the University of Washington. He plans to stay in Seattle. ... **Lola**

Matysiak is living in Boston and pursuing graduate studies at MIT's Technology and Policy Program. ... **Michael Niles** is working as a member of the technical staff at Trimble Navigation, Ltd., in Sunnyvale, Calif. Trimble makes electronic navigation equipment that uses signals from the Global Positioning System, which is a constellation of satellites developed by the U.S. government. ... **Linda Call** is studying in the division of medical sciences at Harvard University while she pursues a PhD in genetics. She often gets together with **Beth Nickerson**.

William Bankhead called me to say that he is sharing an apartment with **Mark Dunzo** in Oakland while both attend Berkeley for graduate work. William is studying in the political science department, but finds his research job in the transportation center a way to make money from his MIT aero/astro background. William enjoys seeking other West Coast alums at Stanford and Berkeley, and says he has learned to appreciate MIT's computers and campus night life. Mark says that students need to buy their own blue-books for exams because of the California budget crisis. Mark is studying in a joint master's program in transportation and urban planning.

Julie Gupta is in the co-op master's program and worked at IBM near New York City. ... **Cheryl Klepser** is living in Ashdown while she finishes a master's in a similar program. Until January, Cheryl worked in East Hartford on her thesis at Pratt & Whitney Aircraft. She lived with her grandparents last fall and writes that she has started looking for jobs in case she chooses not to pursue a PhD. Cheryl and **Lynore Abbott** meet at a mall halfway between their houses to shop and catch up with each other. Lynore is pursuing a PhD in polymers at UMass/Amherst, and has become involved with their crew program. Cheryl sends news about some of our other classmates: At Cornell, **Laura Beecroft** is pursuing a polymers PhD; she has found the Cornell boat house and is rowing. **Ken and Jenny Zemach** are enjoying their two cats and their condominium while going to graduate school at MIT. They headed to Hawaii for Christmas to juggle. ... **Susan Jackson** took anatomy at Johns Hopkins Medical School and after cutting up a cadaver thinks our bodies are pretty impressive in the way all the parts work together efficiently. Susan is still keeping in touch with **Gary Quick**, who is working in Houston.

Nicola Bird is living in New Jersey, working for an environmental consulting company. She gets to wear "big white chemical protective shirts and breathe through a respirator and oxygen tanks" as she pokes around some of New Jersey's toxic waste sites. She says there are so many sites that "(I) never need fear losing my job." She may also get to spend some time in Puerto Rico, which is in the same EPA division as New Jersey. Nicola discovered the Young MIT Alumni Club of New York and now spends most of her free time in New York City. She enjoyed the opportunity to meet with other MIT alums at a crowded party at the Crane Club hosted by **Sharlene Day**, **Christina Boyle**, and **Sara Bottfeld**, among others. Nicola sends news about several classmates: **David Carroll** studied Spanish in Guatemala before returning to Texas in December. **Susan Hsu** is going to George Washington University Medical School and loves it, except for the constant smell of formaldehyde. **Christina Liu** is working for Intel in Oregon. **Miriam Shames** enjoys her studies at Fordham Law School.

Paul Antico and I were loading our Christmas tree on top of his car near Faneuil Hall a few weeks ago. When we realized we had it tied on the wrong way, we started to turn it around. Someone who had noticed our situation, yelled, "Hey, what are you guys, a couple of MIT grads or something?" Like good HASS alums, we chose not to comment. ... If you've got your own Faneuil Hall story, or some interesting news about yourself, please send it my way.—**Andrew Strehle**, secretary, 12 Commonwealth Court #10, Brighton, MA 02135, (617) 232-2261

I CIVIL ENGINEERING

Masanori Yamauchi, SM '85, sends word: "Since 1988 I have been in New York. I am VP and general manager of U.S. operations for Meijiseimei Realty of America, Inc., a subsidiary of the Aleiji Mutual Life Insurance Co. of Japan, the fourth largest life insurer in Japan. So far, I have bought several large office buildings in the U.S. for the company." . . . From Venezuela, **Simon Zisman**, SM '90, writes: "I am currently working for Arthur D. Little in Caracas and am enjoying every minute of the experience! Working for a management and technological consulting firm is giving me the opportunity to complement the fantastic engineering education I received from MIT. Greetings to all Course I folks!" . . . **Thomas Ragno**, SM '85, writes: "I am currently the director of leasing for the Candler Building located in downtown Baltimore. Candler, a 500,000-square-foot renovation, is the largest office building in Baltimore. I am employed by The Beacon Companies where I previously was a project manager in the development group and worked on Rowes Wharf and South Station in Boston." . . . From Evanston, Ill., **John N. Ivan**, SM '87, reports: "I am presently a candidate for the degree of PhD in civil engineering at Northwestern University's Transportation Center. I am researching automatic incident detection techniques for signalized urban road networks for a proposed dynamic route guidance system in the Chicago suburbs."

Michael Akel, SM '46, writes: "I retired in 1990 as senior partner of Akel, Logan & Shafer—Architects & Engineers in Jacksonville, Fla. I also retired from the U.S. Naval Reserve as a captain. My last duty station was with the joint staff of the Rapid Deployment Command at McDill AFB in Tampa, Fla., and later with the U.S. Central command, its successor. I had several operational assignments including duty in the African area." . . . **Alberto B. Calvo**, SM '72, is a staff analyst in the Logistics Engineering Division at TASC. . . . **Katherine Owen-Thompson**, SM '81, was recently promoted to senior engineer at Nolte & Associates in San Jose, Calif. . . . **James P. Gould**, SM '46, has been selected to receive The Moles' Award for



J.P. Gould

"outstanding achievement in construction" for 1992. The awards, considered by many to be the construction industry's most coveted, have been presented annually since 1941. According to their news release, the Moles is a national organization of individuals "now or formerly engaged in the construction of tunnel, subway, sewer, foundation, marine, sub-aqueous, or other heavy construction." Gould has been active for 45 years, "making useful applications of the principles of soil mechanics to heavy construction. He has been affiliated with Mueser Rutledge Consulting Engineers since 1953 and became a partner in 1973. He has gained national attention for his astute technical approach to the geotechnical con-

ditions encountered in construction and for his practical handling of the difficult and complex subsurface problems which are encountered by contractors. He has been in charge of the geotechnical studies for major construction projects throughout the U.S., including the U.S. Navy Drydock No. 6 in Bremerton, Wash., the Throgs Neck Bridge Foundations in N.Y., and the Washington, D.C., Metro Subway."

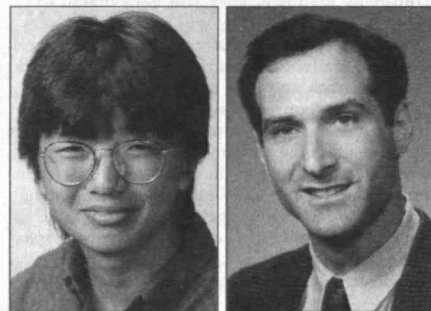
Kevin J. Farley, PhD '84, an assistant professor in the Clemson University environmental systems engineering department, is the recipient of the American Society of Civil Engineer's 1991 Wesley W. Horner Award. Farley was cited for his paper, "Predicting Organic Accumulation in Sediments Near Marine Sewage Outfalls." The award was instituted in 1968 and is made to the author(s) of the paper that makes the most valuable contribution to the environmental engineering profession, specifically in the areas of hydrology, urban drainage, or sewerage, with preference given to those authors who are in the private practice of engineering. . . . **Sallie W. Chisholm**, professor and director of MIT's Woods Hole Joint Program in Oceanography, has been named the recipient of the 1991 Rosenstiel Award in Oceanographic Science. Chisholm is the seventeenth scientist and the first woman to receive the award, which was established in 1971 to recognize outstanding achievement and distinction in oceanographic science. Chisholm, a specialist in microalgae who joined the MIT faculty in 1974, was cited for her "outstanding work on the regulation of cell division cycles in phytoplankton and the application of flow-cytometry to the study of oceanic phytoplankton communities and primary production processes and her role in the discovery of prochlorophyte picoplankton, which are major components of the phytoplankton community over vast regions of the oceans."

MIT Professor **Joseph M. Sussman**, PhD '68, an internationally known expert in rail transportation, has been named the initial holder of the JR East Professorship. The professorship was established with an endowment by the East Japan Railway Co. to foster advancements in teaching and research related to transportation. Sussman has specialized in the planning, investment analysis, operations, management and maintenance of large-scale transportation infrastructure systems, particularly in the rail sector. His research in rail service reliability has had a major impact on operations of railroads in the United States and in other countries. . . . **Uri Schamir**, visiting scholar from Technion University in Israel, has been named president of the Bureau of the International Association of Hydrological Sciences. . . . Professor **P.S. Eagleson**, ScD '56, was awarded the International Hydrology Prize at the American Geophysical Union Conference in San Francisco last December. . . . Course I graduate student **Jacqueline Bode** has been selected for inclusion in the Graduate Fellowship for Global Change Program sponsored by the DOE. Subject to performance, the fellowship can be renewed for up to four years. . . . Professor **Rafael L. Bras** has been awarded an honorary degree from the Instituto di Idraulica Agaria, Universita Degli, University of Perugia in Italy. . . . **Ignacio Rodriguez-Iturbe**, Course I senior lecturer, has been awarded an honorary degree from the University of Genoa in Italy. . . . **K.S. Parikh**, ScD

'62, is one of five authors of *Hunger: Beyond the Reach of the Invisible Hand* (International Institute for Applied Systems Analysis, 1991). The report shows why hunger persists, why many policies advanced in popular literature do not work, and what kind of policies can work.

II MECHANICAL ENGINEERING

John Alden Clark, SM '49, ScD '53, sends word from Ann Arbor, Mich.: "It was a great thrill to attend the May 1991 Inauguration of **Chuck Vest**, a friend and former colleague. . . . **Edward T. Bullister**, SM '83, PhD '87, became president of Nektonics, Inc., last September. . . . **Kenneth N. Astill**, PhD '61, writes: "I have retired after 43 years of teaching at Tufts University, becoming professor of mechanical engineering emeritus in May 1991. I continue to be active at Tufts." . . . **Richard T. Martorana**, SM '69, was recently appointed division leader of Mechanical Design and Analysis at Draper Lab. . . . **Arthur E. Bergles**, '57, SM '58, PhD '62, dean of engineering at Rensselaer Polytechnic Institute in Troy, N.Y., received the Donald Q. Kern Award of AIChE for "major contributions to the field of enhanced heat transfer." He was recently elected a Fellow of ASHRAE for contributions to research in thermal environmental engineering. . . . **Julie Chen**, '86, SM '88, PhD '91, has been named an assistant professor of aerospace and mechanical engineering at Boston University's College of Engineering. Chen, who specializes in the mechanics of composite and fibrous materials, has conducted research at



J. Chen

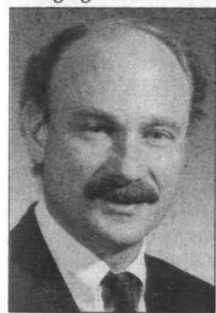
A. P. Shapiro

MIT, Xerox Corp. in Webster, N.Y., and Massachusetts General Hospital. . . . **Andrew P. Shapiro**, SM '87, PhD '90, has joined the General Electric R&D Center in Schenectady, N.Y., as a mechanical engineer. Prior to joining GE, Shapiro was a solar engineer from 1983-85 with Besten Advanced Energy Products in Fort Collins, Colo. . . . From **Ron J. Sticinski**, SM '83, OCE '83 (XIII), in Tybee Island, Ga.: "I work as a mechanical engineer for Intermarine USA. My company is designing and building the USS *Osprey*, a coastal mine hunter for the U.S. Navy. My work involves the ship's fire fighting systems and mine neutralization systems."

Frank M. White, SM '56, professor of mechanical and ocean engineering at the University of Rhode Island at Kingston, received the Fluids Engineering Award from ASME. The award, established in 1968, is given for contributions to the engineering profession, particularly to fluids

engineering through research, practice, or teaching. White is receiving the award for "exceptional contributions to fluids engineering through scholarly teaching and writing, and for dedicated service to ASME as editor of the *Journal of Fluids Engineering*." White, who has been with URI since 1967, was one of the cofounders of the school's Department of Ocean Engineering. . . . **James H. Williams, Jr.**, '67, SM '68, has been appointed to the School of Engineering's Professorship in Teaching Excellence for a five-year term. The professorship was established by an anonymous gift to recognize teaching excellence and to support educational program development. Williams' contributions to undergraduate teaching have been formally recognized through a number of awards, including the Everett Moore Baker Award for "outstanding undergraduate teaching" in 1973, and in 1981 he received the inaugural J.P. Den Hartog Distinguished Educator Award in the Department of Mechanical Engineering. Williams is known for his intellectual rigor and commitment to minority student development.

W. David Lee, '69, SM '70, has been named managing director of Arthur D. Little's



W.D. Lee

Technology and Product Development business. A VP at ADL since 1985, Lee has concentrated his recent efforts in the area of design and development of consumer products, HVAC equipment, and special military and aerospace hardware. He joined the firm in 1972. . . . **Fredric F. Ehrich**, '47, ME '50, ScD '51, is the author of *Handbook of Rotordynamics* (McGraw-Hill, 1992). "Focusing on the safe, quiet, and trouble-free operation of rotating machinery, the book examines both the theoretical and the practical aspects of high-speed rotating machinery—with thorough coverage of design, analysis, development, production, and maintenance functions," states a publisher's press release. **Stephen H. Crandall**, PhD '46 (XVIII), Ford Professor of Engineering in MIT's Mechanical Engineering Department, and **Melvin A. Prohl**, '37, SM '38, engineering consultant in Boxford, Mass., contributed chapters to the book. Ehrich is a senior staff engineer for General Electric Aircraft Engines.

The Alumni/ae Association has been notified that **Morgan L. Foster**, SM '51, of Meadville, Pa., died on January 11, 1990. Foster was president of Fosteration.

III MATERIALS SCIENCE AND ENGINEERING

Daniel J. Lichtenwalner, PhD '90, writes: "I have been enjoying my position as a post-doctoral researcher at North Carolina State University since graduating." . . . From Edenville, South Africa, **Peter A. Laxen**, SM '51, writes: "I retired as Mintek Consultant from the Council for Mineral Technology in Randburg at the end of 1991. In 1982 I received the Annual Percy Fox Foundation Award for my role in introducing the Carbon-in-Pulp process into the gold industry in South Africa." . . . **Thomas C. Tiearney, Jr.**, PhD '78, reports: "I am currently senior project engineer with GE Medical Systems in Milwaukee, Wis. I have four issued patents and one filed patent in the area of X-ray tube technology." . . . **In-Joo Chin**, PhD '83, sends word: "I was recently promoted to associate professor in the Department of Polymer Science and Technology at Inha University in Incheon, Korea." . . . **Jack Salerno**, PhD '83, reports: "Mary Cross, SM '80

(XV), and I am pleased to announce the births of Katie and Julie on August 12, 1991. They join Jennifer, 3. I am a VP at Kopin Corp. in Taunton, Mass., and Mary is a senior product manager at BBN Software in Cambridge." . . . Sculptor **L. David Bakalar**, ScD '51, has been named to the board of trustees at Massachusetts College of Art in Boston.

Deborah D.L. Chung, SM '75, PhD '77, professor of mechanical and aerospace engineering and director of the Composite Materials Research Laboratory in the School of Engineering and Applied Sciences at the University of Buffalo in New York, has been selected as the holder of the Niagara Mohawk Power Corp. endowed chair in Materials Research. The professorship was established in 1989 to attract and retain a nationally recognized teacher and scholar in the field of energy-related materials. She joined the faculty at UB in 1986 from Carnegie-Mellon University. Chung was recently awarded nearly \$1 million in new sponsored research grants, including a \$3/4 million grant from the DOE for research on materials for heat transfer in electronic packages. . . . **William R. Prindle**, ScD '55, associate director of R&D and Engineering for Corning, Inc., and **Steven S. Hansen**, '73, SM '75, ScD '78, supervisor of steel product development at Homer Research Laboratories of the Bethlehem Steel Corp., have been named Fellows of ASM International. Prindle was cited for "significant contributions to the R&D of ceramic and glass production and application technologies." Hansen was cited for "outstanding contributions to the fundamental understanding of the physical metallurgy of microalloyed and dual phase technologies and their application to steel products."

IV ARCHITECTURE

Mario Bemergui Attias, '62, sends word from Caracas, Venezuela: "I am senior partner at Beeme International Planning and Architecture. I worked on the design of the Great Mosque of Smara, and designed and planned in the cities of Smara, Gulimine, Assa, and Tata in the Sahara." . . . **Robert Breuer**, MCP '62, retired from the N.Y. State Department of Transportation and is now consulting in transportation planning and engineering. . . . **Jenny P. Scheu**, MAA '79, reports: "My small firm, Redhouse Architects, has kept busy despite a devastating recession here. I now have a two-year-old son, Thomas Ryan, who I enjoy spending time with too." . . . **Owen Martinez-Sandin**, MCP '60, sends word: "I was recently designated to the technical committee to advise the Puerto Rico Commission for the 2004 Olympics, to be held in San Juan. I will participate in the supervision of technical studies and in the drafting of the 2004 proposal to the International Olympic Committee." . . . From Portland, Ore., **Aron Faegne**, MAR '76, writes: "My firm, Aron Faegne & Associates, has recently hired **Craig Witte**, MAR '90, to work on design of a 9-1-1 Communication Center for the City of Portland."

Paul R. Dermanis, MAR '59, reports: "I have been a partner in Streeter/Dermanis & Associates, a 25-person firm located in Seattle, Wash., for almost 20 years. In this time the firm's practice has been mostly in institutional buildings, including projects for many of the state's 2-year and 4-year colleges. Recently the firm moved to a downtown location across from the new Seattle Art Museum." . . . **James R. Widder**, SM '85, sends word: "I am teaching at the University of Minnesota as an adjunct professor when my schedule permits. I am practicing as a senior project designer for BWBR, Inc., of St. Paul, Minn. A notable building is the University of Minnesota's Basic Sciences & Biomedical Engineering Building." . . . **Bharat M. Gami**, MAA '79, writes: "I am a housing and planning consultant for

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Video Verité

When he first got to know Adolph Judas Snow, Barry Strongin was so captivated that he regularly visited Snow's tiny Long Island apartment. Tape recorder in hand, Strongin would ask Snow about his Horatio Alger-like rise from a teenage immigrant who arrived alone in this country to a career as a professor and later as inventor/executive for Sears Roebuck. Two years ago, when the 97-year-old Snow and his 70-year-old wife, Aida, told their visitor they were heading off on an annual ski trip, Strongin packed his bags, too.

"My story antennae went up," says Strongin, SM '84, a video producer/cameraman whose corporate video work funds his real love, documentaries. "The trip gave me a framework, a story with a beginning, middle, and end."

It also gave him enough good material to win the grand prize of a 1991 national video contest sponsored by Sony Corp. and the American Film Institute. Judges Rob Reiner, Francis Ford Coppola, LeVar Burton, and other entertainment-industry heavies told Strongin that the frail star of his *Gray Rocks* video—who is seen flirting with young female clerks, hoisting his skis and gear, schussing down the slopes, and ruminating after a meal—brought tears to their eyes.

"It's a wonderful human portrait," agrees Glorianna Davenport, assistant professor of media and technology in MIT's visual studies program. The ability to make viewers connect with Snow is one of Strongin's strengths, she says; skillful editing is another.

"Knowing when to turn the camera on and off"—that it's okay to leave some parts of a story out, or not tell them for a while—is what distinguishes award-winning film from amateur home videos, she says.

AT MIT, Strongin studied under Davenport's predecessor, Professor Emeritus Richard Leacock, known as the "father" of cinema verité. One of Leacock's contributions, says Strongin, was creating

portable film cameras, making it "possible to take the camera off its tripod and get closer to people." Strongin's master's thesis was a video documentary of construction workers building the Red Line subway tunnel from Harvard Square west to Arlington. Called *Scenes from Underground*, the video won two awards in 1984: MIT's Wiesner Award for outstanding documentary video work and the American Film Institute's national competition.

Strongin says his aim in making what he calls "video verité" is to get to the point where his subjects are so comfortable in front of the camera that they forget about it. That wasn't much work with A.J. Snow, he admits: "Nothing makes him uncomfortable." But one of the most revealing segments in *Gray Rocks* comes when Aida, who has been more self-conscious on camera, talks to Strongin about her husband. With 27 years between them, A.J. once was more her surrogate father, but their roles have reversed. "I do have to be a bit careful," she says. "He has this feeling of dependence and interdependence. Sometimes when I'm taking care of him, he gets a little bothered about me being so obvious about it."

Winning a national contest judged by the likes of Reiner and Coppola is probably as close to fame as a documentary producer could hope to get. Clips of *Gray Rocks* were even shown on the national television show, *Entertainment Tonight*. Some friends have advised Strongin to move from New York to Hollywood and try to cash in on the exposure. Not likely, he says. "I do this not with the intent of becoming famous and wealthy, but because it brings me great pleasure. I'm learning something about people's lives."—Lisa Watts □



Filmmaker Barry Strongin, SM '84, (above) and Aida and A.J. Snow (below), the subjects of *Gray Rocks*, his award-winning video.

affordable housing in Newark, N.J. This project is developed by the housing authority of the City of Newark, and it involves design and construction of 100 new units on eight different sites. I am also an international expert with the United Nations Centre for Human Settlements (Habitat) for their projects in the Third World."... From Tokyo, Katsuyoshi Otsuki, MAA '73, reports: "I established a consultant office named Sasaki Environment Design Office (SEDO) about three years ago. The objective of our office is to attain a comprehensive balance, ecologically, economically, and aesthetically in new development or/and redevelopment of our environment."... From Key Biscayne, Fla., William P. Thompson, SM '90, writes: "I have a son! Antonio William Thompson or 'Tony.' My present job is VP of the Commercial Real Estate Department at First Union National Bank in Miami."

Eugene D. Cizek, MCP '66, sends word: "I am professor of architecture and Latin American studies at Tulane University. I recently took student groups to Cuba, Mexico, and China, and I will lead a 1992 summer study group to China. I recently received the Hartnet T. Kane Award from the Louisiana Landmark Society for my work in historic preservation education. I am program chair for the 1991 Association of Preservation Technology International meeting."... Richard C. Berg, MAR '86, writes: "I became a registered architect in June 1991. I am now working for Timbercraft Homes in Port Townsend, Wash., the oldest and most established builder of traditional and contemporary timberframe structures on the West Coast."... Martha D. Pollak, PhD '85, reports: "I have published *Turin 1564-1680: Urban Design, Military Culture, and the Creation of the Absolutist Capital* (University of Chicago Press, 1991), and *Military Architecture, Cartography, and the Representation of the Early Modern European City* (Newberry Library/University of Chicago Press, 1991)."... From Zanzibar, Tanzania, Alfred F. De Costa, SM '89, writes: "From November 1989 to July 1991 I worked as an architect/architectural researcher for the architectural and preservation planning firm of Nottter Finegold & Alexander, Inc., in Washington, D.C. Projects included renovation for the U.S. Holocaust Memorial Museum Administrative Center and the Department of Veterans' Affairs Building Restoration; both in Washington, D.C. Since October 1991, I have been working as a technical consultant and project supervisor for The Aga Khan Cultural Services in Zanzibar. Projects will include various architectural and urban restoration and rehabilitation works within the old stone town of Zanzibar."... M. Wayne Stoffle, MAR '40, writes: "I lost my Margie after 52 years of marital bliss on July 6, 1991."... Kip G. Thompson, SM '86, is VP for leasing and development with the Nelson Companies in Waltham, Mass. ... John H. Larson, MCP '55, chair of the City of Bridgeport, Conn., has been named to the board of directors at the Bay State Gas Co. in Westborough, Mass.

The Alumni/ae Association has been notified that Douglas K. Tannatt, SM '87, of Philadelphia, Pa., died on October 19, 1991. Tannatt was a project manager at Schindler Greenfield, Inc., in Philadelphia.

V CHEMISTRY

From Shaker Heights, Ohio, Joel A. Yancey, PhD '53, writes: "I retired on April 1, 1991 from BP America, where I was in the Analytical Science Department working in gas chromatography."... Robert M. Simon, PhD '82, reports: "I was recently appointed principal deputy director of the Office of Energy Research in the U.S. Department of Energy in Washington, D.C. My wife, Karen, and I are happily settled in the College Park, Md., area, and have two children, Stephen, 6, and

Cathryn, 2, and are expecting our third."... **Kenneth E. Apt**, PhD '71, writes: "I have been appointed program manager for Arms Reduction Treaty Verification at the Los Alamos National Laboratory. As such, I am responsible for management and development of programs of verification for START, CFE, CWC, INF, Open Skies, and nuclear warhead dismantlement."... **Michael J. Natan**, PhD '86, reports: "I have taken a position as an assistant professor in the Department of Chemistry at Pennsylvania State University."... **James J. Burke**, PhD '62, sends word: "I retired from Monsanto Corporate Research as a senior science fellow with 33 years service and joined Air Products and Chemicals, Inc., as principal research associate in Membranes at their Permea, Inc., subsidiary in St. Louis."... **Alan M. Ehrlich**, SM '65, PhD '68, reports: "I have been working 11 years at EPA as an environmental scientist. I recently completed my JD at George Washington University and am now working in EPA's Office of General Counsel where I work on patents and the Federal Technology Transfer Act."

Dabney White Dixon, PhD '76, writes: "I am now an associate professor in the Chemistry Department at Georgia State University. Our research is in biological electron transfer."... In Westlake Village, Calif., **John Viola**, PhD '67, is continuing to work on development of infrared detectors and seeking commercial applications.... **Michael J. Abrams**, PhD '83, is worldwide manager of biomedical research for Johnson Matthey in West Chester, Pa.... **Mark L. Lee**, PhD '76, has been promoted to senior director of business development at Bristol-Myers Squibb Pharmaceutical Group in Princeton, N.J.... **Mark A. Smith**, SM '78, writes: "I was promoted to associate professor with tenure in the Chemistry Department at the University of Arizona's Division of Physical Chemistry. I am working in the area of gas phase kinetics at extremely low temperatures and energies."... From **Raymond Vrtis**, PhD '90: "I accepted a position at Air Products & Chemicals. I am currently working at Schumacher Co., a subsidiary of Air Products & Chemicals, located in Carlsbad, Calif."... **Carl A. Renner**, PhD '74, was married on May 4, 1991 to Renée Landry of Winnipeg, Manitoba.... **John S. Murdzek**, PhD '88, sends word: "I started work as a college textbook editor in January 1991 for Mosby-Year Book, Inc., in Boston. In my spare time I follow the Red Sox and perform in local clubs as a stand-up comic."

James R. Aronson, PhD '58, reports: "I left Arthur D. Little, Inc., after 27 years, and am now a private consultant specializing in infrared science and technology and related software development."... **Paul Carlier**, PhD '88, writes: "After three interesting and enjoyable years at Polaroid Corp. in Cambridge, I have joined the charter faculty of a new (English-language) university, the Hong Kong University of Science and Technology. My responsibilities include teaching and research in organic chemistry."... Last year **John P. Selegue**, PhD '79, was promoted to professor in the Department of Chemistry at the University of Kentucky.... From Simi Valley, Calif., **Richard B. Kurz**, PhD '71, sends word: "I left my position with the Department of OB/GYN at St. Louis University School of Medicine. In that position I served on the perinatal advisory committees for the Departments of Public Health for the States of Illinois and Missouri. I was also appointed by the Governor of Illinois to serve on the Infant Mortality Reduction Advisory Board for the state. I have now assumed a faculty position with the UCLA School of Medicine in the Department of OB/GYN where I am senior perinatologist for the newest Los Angeles County Hospital, the Olive View Medical Center. I am also serving on the perinatal advisory committee for the County of Los Angeles' Department of Health Services."... From Nashua, N.H., **Jim Snow**, PhD '87, writes: "I started work in June

1991 as a research scientist in the corporate research division of Millipore Corp. in Bedford, Mass. I am working on the Waferpure product, a purifier for gases utilized in the microelectronics industry. My wife, Melody, gave birth to our daughter, Danielle Kristen, in February 1990."... **Timothy Curran**, PhD '88, was appointed assistant professor in the Chemistry Department at Holy Cross College in Worcester, Mass., last September.... **Mankil Jung**, SM '78, sends word: "I have been promoted to associate professor in the School of Pharmacy at the University of Mississippi. I am currently engaged in synthesis of natural products like artemisinin, taxols, and beta-lactams. I hold two U.S. patents on anti-malarial drugs."

Robert A. Duce, PhD '64, has been named dean of the College of Geosciences & Maritime Studies at Texas A&M University in College Station, Tex. Previously, Duce was dean of the University of Rhode Island Graduate School of Oceanography in Narragansett, R.I.... **William D. Phillips**, PhD '51, has been named to the board of directors at Celgene Corp. in Warren, N.J. He continues to work at Washington University in St. Louis, Mo.... **John Ross**, PhD '51, the Camille & Henry Dreyfus Professor of Chemistry at Stanford University, has received the 1992 Irving Langmuir Award in Chemical Physics by the American Chemical Society. Ross has made major experimental and theoretical contributions to such areas of chemistry as nonlinear kinetic instabilities, stabilizing of unsteady states, research into chemical waves, understanding of period precipitation phenomena, "alternating current chemistry," and biological pumps. The award is sponsored by the General Electric Foundation.

VI ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

Naveed Akhtar Malik, ScD '82, sends word from Pakistan: "I have helped to establish the Department of Computer Science at the University of the Punjab. I have transferred from the Centre for Solid State Physics and am currently serving as chair of the new department."... **James M. Ham**, SM '47, ScD '52, is president emeritus of the University of Toronto and was president of the Canadian Academy of Engineering from 1990 to 1991.... **J.T. "Dale" Madill**, SM '40, writes: "I retired from Alcan and recently located in Kingston, Ontario. I am on review boards for several large hydroelectric projects in various parts of the world. I do a lot of downhill skiing, some swimming, and sailing in a very small dinghy."... **C. A. Desoer**, ScD '53, sends word: "I took partial retirement from the Department of Electrical Engineering and Computer Science at the University of California at Berkeley on July 1, 1991. My book *Linear System Theory* with co-author F.M. Callier was published by Springer last August."... **Rob Hastings**, SM '88, reports: "I joined Adaptive Corp. in July 1990. Adaptive Corp. is a majority-owned subsidiary of N.E.T. engaged in the design, development, and marketing of high-bandwidth communications products for large corporations and telecommunications carriers. Founded in August 1989, the company is based in Redwood City, Calif."

From Methuen, Mass., **Howard Reeve**, SM '83, writes: "My pro golf career has fizzled, so I'm sticking to engineering as my long-term career. I'm playing the amateur golf circuit as a hobby now. Has **Norman "Gil" Briston**, Jr., SM '83, made it on the Florida mini-tennis tour, yet?"... **Akinori Yonezawa**, PhD '78, sends word: "I am a professor of computer science in the Department of Information Science at the University of Tokyo. I have published *Object-Oriented Concurrent Programming* (MIT Press, 1987), *ABCL: Object-Oriented Concurrent Systems* (MIT Press, 1990), and *Concurrency: Theory, Language, and Architecture*

(Springer Verlag, 1991)."... *Transmission Lines and Wave Propagation*, 3rd Edition by **Philip C. Magnusson**, ScD '41, **Gerald C. Alexander**, SM '60, and **Vijai K. Tripathi**, has been published by CRC Press, Inc., in Boca Raton, Fla. The authors are members of the faculty of the Department of Electrical and Computer Engineering at Oregon State University in Corvallis, Ore.... From Hollis, N.H., **Frederick Q. Gemmill**, SM '39, reports: "I'm retired but active in town government and with a small business of land surveying."... **Lori L. Vinciguerra**, SM '87, writes: "**Ralph Vinciguerra**, '80, SM '82, PhD '88, and I are still working very hard on our house in Reading, Mass. We have enjoyed all the visits from past Ashdownites. Ralph is now working at TASC in Reading and commutes via mountain bike!"... From Lexington, Mass., **Ervin F. Lyon**, SM '59, PhD '66, reports: "I'm actively involved in the development of automation systems for use in the control towers of major airports."

Louis Weinberg, ScD '51, writes: "Is there life after retirement? Of course there is. I've just had a paper accepted for publication in the *IEEE Transactions on Circuits and Systems*. It's called 'On the Generation of d-Ordered Sets: A Proof Based on Determinant Theory.' A d-Ordered set is a higher-dimensional generalization of a one-dimensional totally ordered set and is equivalent to an oriented matroid. Earlier in the year while on a visit to Israel I gave a talk at the Technion on 'The Principal Partition of a Graph (A Matrix and a Matroid)' and I am hoping to complete a book on graphs and matroids. Matroids, I feel, will soon be as familiar to engineers as matrices, but that time is not now. But why can't there be a fuller, better life after retirement? I miss teaching and the students, especially supervision of the graduate students, the excitement, the thrill of doing research with them and learning from them. So, if an opportunity presents itself, I'll go back to teaching at some research university."

Robert H. Eisengrein, SM '49, sends word: "I've been retired for 10 years, but I'm active technically as a citizens' group project manager for a local superfund site. I'm also politically active locally. I'm still playing tennis and am active with eight children, six grandchildren."... **Robert Piankian**, SM '72, and **Esther J. Horwich**, '77, spent a three-week vacation in Kenya and Tanzania. They went on a photographic safari and spent several days scuba diving in Mombassa in the Indian Ocean.... **Paul M. Thompson**, PhD '88, writes: "My wife, Katherine Owen-Thompson, SM '81 (I), was recently promoted to senior engineer at Nolte & Associates in San Jose, Calif."

Glen S. Miranker, SM '77, PhD '79, has been named VP for engineering at Tera Microsystems in Santa Clara, Calif. Prior to this new position, Miranker was chief architect at Stardent Computer.... **Lee Makowski**, SM '73, PhD '76, a specialist in molecular biophysics, has been promoted to professor of physics at the Boston University College of Liberal Arts. Makowski,



L.H. Carney

who joined the BU faculty in 1987 as an associate professor, also works as a guest assistant scientist at Brookhaven National Laboratories in Upton, N.Y. Previously, he was a senior research associate at Brandeis University and an assistant professor at Columbia University.... **Laurel H. Carney**, '83, has been named an assistant professor of biomedical engineering at Boston University's College of Engineering. Carney joined BU from the University of Pennsylvania, where she was a lecturer and postdoctoral fellow. She has also held

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teaching and research positions at the University of Wisconsin at Madison. . . . **Steven Irl Marcus**, SM '72, PhD '75, the L. B. (Preach) Meaders Professor in Engineering at the University of Texas at Austin, has been appointed director of the Systems Research Center at the University of Maryland at College Park. . . . **Philip F. Bagwell**, SM '88, PhD '91, assistant professor of electrical engineering at Purdue University, is one of 20 young researchers nationwide to receive a fellowship from the David and Lucile Packard Foundation. The fellowship provides a young faculty member in science or engineering with \$10,000 per year for five years to support his or her scientific research. Bagwell works in solid-state physics and semiconductor fabrication. He has conducted research in quantum transport, specifically nanometer-sized conductors and superconductors that may have applications in electronics.

Roy D. Shapiro, '68 (XVIII), SM '71, EE '71, a member of the Harvard Business School faculty since 1974 and an expert in production and operations management, logistics, and supplier management, has been named the Jesse Phillips Professor of Manufacturing. "Shapiro's current research," states a Harvard news release, "involves a multiyear, field-based project aimed at comparing and evaluating the design and management of state-of-the-art logistics networks in the United States, Western Europe, and Japan. In particular, he is focusing on innovative interorganizational systems and management approaches that integrate the coordinate flows of material and information to reduce or eliminate the myriad non-value-added or duplicative activities that so often characterize supply, manufacturing, and distribution channels. His research seeks to establish a clearer understanding of the economic implications of such coordinated endeavors, the mechanisms that are most effective, and the nature of the interorganizational relationships that ensue." . . . **John G. Truxal**, '47, ScD '50, distinguished teaching professor emeritus in the Department of Technology and Society at the State University of New York at Stony Brook, has received the Rufus Oldenburger Medal of ASME. The medal, established in 1968, is given for outstanding achievements in the field of automatic control and is named for that field. Truxal was cited for "his pioneering work in the education of control engineers, including the authorship or coauthorship of three widely used textbooks and the editorship of the definitive *Control Engineers' Handbook*, and for the many ways in which he has promoted a better understanding of the role of technology in the conduct of human affairs." During the last 20 years, Truxal's principal efforts have been directed toward the development of educational materials for minorities in engineering activities and teaching of technology to general students. He is currently codirector of the Stony Brook Center for the Sloan Foundation's new liberal arts program.

Rear Admiral **Edward A. Ruckner**, SM '41, of Annapolis, Md., died on September 12, 1991. Ruckner spent much of his career as a gunnery and ordnance officer. His sea duty included command of the battleship *Mississippi* during a series of guided missile tests in 1955 and command of the cruisers and destroyers of the Atlantic Fleet from 1965 to 1967. During World War II he served in the Navy's old Bureau of Ordnance, then became gunnery officer of the cruiser *Memphis* in the Atlantic. He ended the war aboard the cruiser *Atlanta* and took part in the occupation of Japan. In 1967 he became deputy chief of naval operations for R&D, a post he held until shortly before his retirement in 1971. During that period, he also was chair of the NATO naval armaments group. Ruckner's military decorations included the Distinguished Service Medal and two awards of the Legion of Merit. . . . **Larry G. Glassmaker**, SM '58, of Palos Verdes Peninsula, Calif., died of cancer

on September 29, 1991. Glassmaker was an electrical engineer at TRW for 30 years and an usher at his neighborhood church. . . . The Alumni/ae Association has been notified that **John C. Herbert**, SM '33, of Erie, Pa., died on October 29, 1991. There was no further information provided.

VI-A INTERNSHIP PROGRAM

The EECS faculty met last November, at the behest of Department Head **Paul L. Penfield, Jr.**, ScD '60, to hear a report from the department's Committee on the First Professional Degree, proposing a new five-year program to be the department's primary professional degree program. This "First Professional Degree in Course VI" curriculum would lead to the awarding of a professional Master of Engineering degree after five years, plus an accredited SB degree for the more specialized undergraduate curriculum to be associated with this five-year curriculum. Details of this proposal will have become public by the time this article appears, so I will leave it at that. One need, associated with the proposal, is that of financial assistance for the students taking the additional fifth year. This need can be met in several ways (i.e. via TA's, fellowships, etc.), and by increasing the percentage enrollment in the department's VI-A Internship program. According to VI-A Director **Kevin J. O'Toole**, SM '57, NE '57 (XIII), anticipation of the establishment of this new curriculum has led to a decision to allow the addition, this spring, of several new companies to the VI-A Program. If and when the new Professional Degree program gets into full swing, additional expansion of VI-A may be allowed.

For this year, the new companies being welcomed are: the General Motors Corp., Hughes, Intel Corp., and the Jet Propulsion Laboratory. They will be on campus this spring, taking part in the annual VI-A selection process. One of the winners of the 1991 National Medal of Technology awards announced by President Bush is **C. Gordon Bell**, '56, SM '57, VP of Ardent Computer of Sunnyvale, Calif. He was cited for "his continuing intellectual and industrial achievements in the field of computer design; and for his leading role in establishing cost-effective, powerful computers which serve as a significant tool for engineering, science, and industry." We congratulate Gordon on this honor. . . . The Council of the American Physical Society has honored MIT's Professor **Hermann A. Haus**, ScD '54, by electing him a Fellow of the Society. His Fellowship Certificate reads: "For pioneering and sustained contributions to the understanding of laser modelocking, optical waveguide devices, and quantum optics." Haus served as VI-A faculty advisor to the AVCO-Everett Research Corp. for many years during my tenure as VI-A director.

The MIT Public Service Center awarded twenty \$1,200 Fellowships to undergraduates for public service projects to be undertaken in cooperation with local community organizations. A VI-A'r, **Mark G. Duggan**, is a recipient of one of these awards. . . . The December 1991 issue of *MIT Parent News* carries as its lead article "Learning in the Real World—Internships for Engineers." The article describes the VI-A Internship Program and EIP (Engineering Internship Program). . . . Recent visitors to the VI-A office have included: **Chester M. Day, Jr.**, '57, SM '58, on campus recruiting for Bellcore, **Edward W. Maby**, '73, SM '75, PhD '79, en route from Rensselaer Polytechnic Institute where he's an associate professor, to Maine and Thanksgiving with his father, and **Alan R. Millner**, '70, SM '70, EE '70, ScD '72, manager of the Electronics Systems Group at EML Research, Inc., in Hudson, Mass., who stopped by the day I happened to be with Professor **Amar G. Bose**, '51, SM '52, ScD '56, and his 6.312 class visiting the

VII BIOLOGY

From Israel, **Tom Berman**, PhD '64, writes: "I am presently the director of the Kinneret Limnological Laboratory which serves as the centre for basic and applied studies of Lake Kinneret (Sea of Galilee). Our aim is to understand the workings of this complex ecosystem so that we can [learn] things about what happened in the past and advise on how best to preserve the environment of this historic lake, which is vital to the water economy of Israel. Running the lab and doing a modicum of my own research in aquatic microbiology keeps me busy and off the streets." . . . **Hong Ma**, PhD '88, sends word: "Since I graduated from MIT, a lot has happened in my life and career. Soon after I arrived at Caltech for my post-doc, my wife, Yi, came to the United States from China to join me. We were very happy especially because we had to wait eight long months for her to get permission to leave China. A year later, our son, Jason, was born. We now have a wonderful family. Jason is now two and full of energy. My post-doctoral years were spent cloning several genes from the plant *Arabidopsis thaliana*. Working together with another post-doc in Professor Elliot Meyerowitz's lab, we pulled out a total of eight genes. In mid 1990, I, along with the family, came back to the East Coast, to start my own lab at Cold Spring Harbor Lab in New York. We now have a five-person group with four post-docs plus myself. We are busy studying the genes we isolated. With any luck, we should learn about plant flower development and signalling through these studies."

VIII PHYSICS

Louise Wilson Wholey, SM '68, writes: "I work as a software developer at Measurex in Cupertino, Calif. I enjoy my family and flying a Bonanza, deep-powder skiing, trail running, road and mountain bicycling, windsurfing on San Francisco Bay and Maui, and music." . . . **Yaneer Bar-Yam**, '78, PhD '84, has been named an associate professor of electrical, computer, and systems engineering at Boston University's College of Engineering.



Bar-Yam, who specializes in material growth and superconductivity, joins B.U. from the Weizmann Institute for Science in Israel. Previously, he held scientific and research positions at MIT, IBM, and Cornell University. . . . **Edward W. Webster**, '51, sends word: "At the Annual Convocation of the American College of Radiology held in

Y. Bar-Yam

Minneapolis, on October 1, 1991, I received the Gold Medal of the College. This is the eleventh time the medal has been awarded to a physicist since their inception in 1927." . . . From Palos Verdes Estates, Calif., **Jerry King**, SM '51, reports: "I am finally retiring from my consultant activities so I can find time to do all the more interesting things available now before I am too old to enjoy them—like visiting children and grandchildren with my wife Annette, playing bridge, writing, and whatnot."

Arthur Winston, PhD '54, writes: "I was elected a Fellow of the IEEE for the development of

Memorial to Alan Barrett Established

The first Barrett Prize for exceptional astrophysics research by an MIT undergraduate senior or graduate student will be awarded this spring by a faculty committee based in the Department of Physics. The annual \$1,000 prize honors the influence of Alan H. Barrett, a physics professor emeritus widely known for his contributions to radio astronomy. Barrett died of cancer on July 3, 1991 at the age of 64.



An MIT faculty member from 1961 until his retirement in 1987, Barrett and his MIT associates were the first to detect and measure a molecule in space: hydroxyl, or OH radicals. That work led to the growth of a new field of research on molecules in space. Barrett also codesigned microwave detection equipment used to measure the temperature of Venus on the *Mariner I* and *II* space missions.

In the early 1970s, moving from space to medical science, Barrett and his colleagues developed microwave thermography, a technique for medical imaging. Using the highly sensitive receivers developed for radio astronomy, the method could noninvasively measure human temperature several millimeters beneath the skin. The technique was used to detect the elevated temperature of breast tumors in examinations of thousands of women at Faulkner Hospital in Boston.

For his work on radiation, Barrett shared the 1971 Rumford Prize of the

American Academy of Arts and Sciences. He was awarded a Guggenheim fellowship in 1977 to continue his studies of the molecular properties of the interstellar medium. That same year he wrote the undergraduate physics text, *Electromagnetic Vibrations, Waves, and Radiation* with George Bekefi. He was a consultant to NASA, the National Science Foundation, the National Institutes of Health, the

National Radio Astronomy Observatory, and the National Astronomy and Ionosphere Center.

In a statement from the Harvard-Smithsonian Center for Astrophysics, his colleagues said, "In all his work, Barrett combined an infectious enthusiasm, a pioneering spirit, and a practical, common-sense logic. He was admired by his students for his clarity, consistency, and his friendly manner. He taught by example."

Barrett received a bachelor's degree in electrical engineering from Purdue University and a physics master's and doctorate from Columbia University. He served as a postdoctoral fellow at the U.S. Naval Research Laboratory and as a research associate at the University of Michigan before joining MIT.

The Barrett Prize fund has been endowed by Barrett's students, relatives, friends, and colleagues. Contributions to the fund can be sent in care of the MIT physics department.—*Lisa Watts* □

instrumentation and contributions to the manned space program. I'm a member of the MIT Technology Day Committee and the Ad Hoc Committee for Graduate Alumni/ae Programs. . . .

Captain **J.W. Crawford**, SM '46 (XIII), SM '50, USN (Ret.), writes: "I have been reappointed by President Bush as a board member of the U.S. Defense Nuclear Facilities Safety Board." . . .

Albert Blackwell, '62, has been appointed the Reuben B. Pitts Professor of Religion at Furman University in Greenville, S.C. A member of the Furman University religion faculty since 1971, he is the fourth professor to occupy the endowed chair since it was established in 1966. Blackwell is involved in peace and justice education and is the founding chair of The Piedmont Peace Resource Center. . . . **Henry W. Kendall**, PhD '55, MIT professor of physics, has been selected as the 1991 recipient of the Deefield Academy Heritage Award. He is a 1945 graduate of the academy. The Award is presented annually by the Deefield Academy Alumni Association to recognize distinguished public service and professional achievement. Kendall, who is director, founding member, and former chair of the Union of Concerned

Scientists, was one of the recipients of the 1990 Nobel Prize in physics.

IX BRAIN AND COGNITIVE SCIENCES

William E. Cooper, PhD '76, has accepted the appointment as dean of the Faculty of the Liberal Arts and Sciences at Tulane University. Cooper has been acting dean of the New Orleans university since October 1990. As dean of the 400-member liberal arts and science faculty, Cooper is part of an administrative team responsible for implementing the university's plans for the next five years, including initiatives in international studies and environmental research.

X CHEMICAL ENGINEERING

From Manila, Philippines, **Miguel R. Unson**, SM '42, writes: "I will finally retire from San Miguel Corp. after 45 years of service. My last official

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Kenneth L. Recker, '73
Mark X. Haley, '75
Robin B. Dill, '77
Andrew F. McKown, '78
Keith E. Johnson, '80
Elliott I. Steinberg, '80
Chris M. Erikson, '85
Gretchen A. Young, '86
Christian de la Huerta, '87

position in the company was executive VP for services. During the last few years I have been a consultant to the chairman. I shall not be idle after retiring from San Miguel as I continue to be chairman of the National Quality Campaign under the Philippine Productivity Movement, a private non-profit organization formed by top executives from private enterprise, government, labor, and academe."... **Shintaro Furusaki**, SM '64, is a professor of chemical engineering at the University of Tokyo, and served as head of the graduate course in chemical engineering for 1991. He is organizing the Asia-Pacific biochemical engineering conference slated to be held in Yokohama, Japan in April 1992. He is VP of the Japanese Society of Enzyme Engineering. ... **Robert H. Fariss**, SM '51, ScD '54, reports: "I retired from Monsanto Co. in November 1991 after 32 years of service, the last 21 in charge of R&D for the Saflex business unit."... **Mark Hyman, Jr.**, SM '39, sends word: "I am working with Professor Cornelius Hurlbut of Harvard's Mineralogy Department on a new instrument for measuring high refractive indices of minerals. I'm also still working in the solar energy field, currently on heat storage. I recently attended the golden wedding anniversary of long-time friend **Jim S. Bruce**, SM '39. I've also seen

friends **Charles E. Winters**, SM '39, ScD '42, and **Bob H. Cotton**, SM '39, from Chem Engineering and **Herb E. Hawkes**, PhD '40. (great friend) from geology."

From **C.P. Marion**, ScD '52, in Mamaroneck, N.Y.: "I continue consulting for Texaco Development Corp. I returned in April 1991 from a four-month trip to Madison, Wisc., San Francisco, Taiwan, Hong Kong, Bangkok (where son **G.T. Marion**, SM '71, is general manager at Caltex Thailand), Singapore, Australia, New Zealand, Panama, Jamaica, Curacao, Trinidad, Martinique, and Barbados. Last summer my wife Jane and I cruised in our sailboat, *Liza Jane*, with our inlaws to Cape Cod waters. I visited the Boston Yacht Club in Marblehead to purchase a Nonsuch 30 sailboat in September. I then made a 2 1/2 week trip to Costa del Sol, Spain during October."... **Kate Abbat Threefoot**, SM '84, sends word: "I am an environmental coordinator for DuPont Agricultural Products Research in Wilmington, Del. My husband, Steven, and I have two children, Alan, 4, and Barbara, 6 months."... **Rudolph T. Greep**, SM '34, writes: "I am enjoying retirement at my year-round home on Sebago Lake in Maine, and involvement with both community activities and past business connections."... **William D. Holland**, SM '58, reports: "I am completing 25 years as professor of chemical engineering at Tennessee Tech University in Cookeville, Tenn."... From Seoul, Korea, **Sang-Chun Rah**, ScD '84, writes: "Last April I was appointed general manager for the new business development team at Yukong Limited, the largest oil company in Korea."

From Hamburg, Germany, **Eric Zilberkweit**, SM '58, sends word: "My company, Marketing Technology International (MTI) has prospered. The astonishing events in Eastern Europe have changed business conditions resulting in a sharp increase in demand for our market consulting services in Germany by American and English companies. My family(ies) and children are all well including Josephine (former wife), Ian, 23, Lara, 21, Ute (present wife), and Shanah, 5. My regards to all former students and professors of chemical engineering practice from 1958. If anyone is passing through Northern Germany please give us a call."... **Robert Cotton**, SM '40, reports: "I'm still happily retired here in S.W. Florida. I'm active in ceramics, Great Books, and church activities, when I'm not fishing, gardening, or reading."... From The Netherlands, **James S. Law**, SM '72, writes: "I am now a technology coordinator for John Brown Engineers & Construction, BV, in The Netherlands. I concentrate on keeping abreast of available technologies, conceptual process engineering, and technical sales support. I am looking forward to a visit to the Chemical Engineering Department next month when I come to Cambridge on business. It has been too many years since I have last visited."

Shao Yuen Chang, SM '49, sends word from Torrance, Calif.: "I retired from Northrop Corp. last August, after working there for 17 years as a research scientist with interests in physics and the technology of semiconductor services and circuits. Two of my four children are also MIT chemical engineering graduates. **David M. Chang**, '78, is now the assistant to the president of Citicorp in New York City, and **Karen L. Chang**, '79, is a surgical pathologist at City of Hope National Medical Center in Duarte, Calif."... **Robert Langer**, ScD '74, the Kenneth J. Germeshausen Professor of Chemical and Biochemical Engineering at MIT, is in the news. He has been named to the board of directors at Omni Quest Corp., a maker of magnetic specialty chemicals. He has also been named the recipient of the Charles M.A. Stine Award given by the American Institute of Chemical Engineers' Materials Engineering and Sciences Division. The author of 275 technical publications, Langer is lauded for his contributions to materials engineering and sciences. He developed the first

controlled release systems for proteins and biodegradable polymers. The Award consists of a framed certificate and a \$1,000 honorarium. ...

Ali Nadim, SM '85, PhD '86, has been named an associate professor of aerospace and mechanical engineering at Boston University's College of Engineering. Nadim, who specializes in fluid mechanics, interfacial phenomena, and applied mathematics, joins BU from MIT where he had been an assistant professor of mathematics since 1986.



Harvey G. Stenger, ScD '84, associate professor of chemical engineering at Lehigh University in Bethlehem, Pa., has been appointed director of Lehigh's Environmental Studies Center. The center, established in 1962, supports and develops projects from academic departments across the university. The projects focus on environmental problems, as well as the environmental impacts on biological and geological systems. Currently, the center is involved with the Pocono Comparative Lakes Program at Lackawac Lake, where researchers are investigating the effects of air pollution on the biological activity of the lake. Stenger, who joined the Lehigh faculty in 1984, specializes in reaction engineering and materials processing. ... **John Alam**, '82, has been appointed associate director of clinical research and is medical director of the beta interferon program in the Medical Research Department at Biogen in Cambridge. The department is responsible for conducting the company's clinical trials and evaluating the efficacy and safety of potential new drugs, such as hirulog and beta interferon. ... **Michael L. Mavrovouniotis**, PhD '89, an assistant professor at the University of Maryland's Systems Research Center and Chemical Engineering Department in College Park, has been named the recipient of the 1991 Ted Peterson Student Paper Award given by the American Institute of Chemical Engineers. An expert in computer-aided engineering of chemical and biochemical processes and systems, Mavrovouniotis is receiving the award for his paper, "Computer-Aided Synthesis of Biochemical Pathways." He developed new courses on modern computing techniques for chemical engineering and new techniques for the estimation of properties of chemical compounds and modeling of chemical systems. The award consists of \$500 and a plaque.

XI URBAN STUDIES AND PLANNING

Scott M. Soloway, MCP '88, recently married Deborah Shumagh and they live in Brookline, Mass. He continues to practice corporate law at Rackemann, Sawyer & Brewster in Boston. ... **Enrique Vial-Briceno**, MCP '90, writes: "I continue to work for the National Capital Planning Commission in Washington, D.C., on technology implementation and development. Last October I presented a paper on my experience with NCPC at the third Conference on Geographic Information Systems for Latin America and the Caribbean in Viña Del Mar, Chile."... **Barbara L. Stinson**, MCP '86, is an associate and mediator for The Keystone Center, in Keystone, Colo. The center is non-profit and conducts national policy dialogues to resolve environmental policy disputes. ... **Susan M. Minter**, MCP '91, writes: "I was married on July 6, 1991 and in September moved to Waterbury, Vt. I am currently a Switzer Fellow working in the Vermont office of the Conservation Law Foundation in Montpelier,

Vt."... **Alberto Harth Deneke**, MCP '66 (IV), PhD '78, was promoted to infrastructure division chief of Occidental and Southern Africa with the World Bank. The job covers nine countries. ... **Matthew A. Thall**, MCP '75, sends word: "After 10 years as executive director of the Fenway CDC, I have moved on to become program director of the Boston office of the Local Initiatives Support Corp." ... **M. Ashraf Jan**, MCP '70, writes: "I am the airport planning advisor to the Civil Aviation Authority of Spain, as a member of the FAA Civil Aviation Assistance Group in Madrid since December 1989. Our top priority is the long-term development of Madrid International Airport assisting the DGAC in the application of FAA's models—'Simmod' for airport capacity analysis and integrated noise model for airport noise compatibility studies."

Word from **Lydia A. Kowalski**, MCP '73: "I am enjoying my new life in Los Angeles. In January 1991, I assumed the position of administrative officer for the dean's office in the UCLA School of Engineering and Applied Sciences. Last November I traveled in China for 3 weeks." ... **Vilma Barr**, '73, is the author of *The Best of Neon* (Allworth-Rockport Press, 1992). She is the coauthor of *Designing to Sell: A Complete Guide to Retail Store Planning & Design* (McGraw-Hill, 1990). ... From Bethlehem, Pa., **Irwin Kugelmann**, SM '60, ScD '63, reports: "I received the Lehigh University 1991 Brody Award for Excellence in Teaching & Research and I was elected to the National Council of Department Chairs of Civil Engineering by the ASCE." ... **Clint Andrews**, SM '85 (TPP), PhD '90, writes: "Ellen Cotter and I got married this summer at Walden Pond and moved to deepest New Jersey. Ellen's an occupational therapist at the Princeton Medical Center and I'm a professor at the university's Woodrow Wilson School." ... **William C. Grindley**, SM '72, sends word: "I am managing director of Pacific



A.W. Caner

Strategies, a consulting firm assisting U.S. & European companies competing in Asia and Latin America through its offices in Menlo Park, Calif., Hong Kong, Monterrey, Mexico, and Singapore."

Anthony W. Caner, SM '85, has been appointed VP at Equity Ventures, Inc., a real estate development firm headquartered in

Warwick, R.I. Caner, who joined the firm in March 1989, continues to have full project management responsibilities for Lincoln Center Office Park, a 1-million-square-foot, master planned, suburban office development in Lincoln, R.I.

XIII OCEAN ENGINEERING

Amin Halim Rasip, SM '82, writes: "After leaving MIT in 1982, I worked for one year as an international shipping consultant based in Singapore. In 1984 I became self-employed and started my own shipping company in Malaysia to own and operate ships. By 1989 I built up a small fleet of six coastal ships (tankers and offshore supply vessels). In 1990 I sold off two of the ships to take advantage of the buoyant market, and subsequently diversified into the manufacture of precision metal components/equipment for the oil and gas industry. I got married in 1985 and now have two daughters. I would be keen to meet any MITers seeking business opportunities in the Asian Region." ... From Kingwood, Tex., **Hugh H. Fuller**, SM '73, reports: "I recently transferred from Exxon Production Research Co. to Exxon Co.

International as manager for natuna gas field development." ... **Alvin Y.D. Cheng**, SM '84, sends word: "I am presently a manager with Hagen & Co. Limited in London, which is the advisor to a listed investment fund in Luxembourg. The fund concentrates on investments in shipping and transportation, as well as oil and gas sectors." ... From Singapore, **Hans Hvide**, SM '90, writes: "I am a project manager for Nortrans Shipping. We make floating storage tankers for offshore oil fields. We have a new patented mooring system that we are now marketing in South East Asia, the United States, and Europe. My wife is expecting our second child in May 1992."

Eugene Johnson, SM '71, NE '71, writes: "I retired from the U.S. Coast Guard on June 30, 1991. I'm manager of the Delaware Bay & River Cooperative, established in 1981 by 15 companies to procure oil pollution equipment and maintain it ready in case a large oil spill occurs in the bay or river." ... From **Ron J. Sticinski**, SM '83, OCE '83, in Tybee Island, Ga.: "I work as a mechanical engineer for Intermarine USA. My company is designing and building the USS *Osprey*, a coastal mine hunter for the U.S. Navy. My work involves the ship's fire fighting systems and mine neutralization systems."

Tom Robinson, SM '82, OCE '82, reports: "I am currently enjoying my third year with Old Dominion University in Norfolk, Va., teaching and working on a dissertation in organizational learning. I am part of a small group, of PhD students and faculty who have this year founded a research group which is part of the Old Dominion University Research Foundation, that we call the Change Management Network, a corporate-academic partnership seeking practical breakthroughs in the field of change management. We have, so far, gained sponsorship and are working closely with five large regional, national, and multi-national corporations." ... **Captain J.W. Crawford**, SM '46, SM '50 (VIII), USN (Ret.), writes: "I have been reappointed by President Bush as a board member of the U.S. Defense Nuclear Facilities Safety Board." ... Vice Admiral **Clarence R. Bryan**, NE '52, is chair of the advisory committee for the U.S. Coast Guard Academy. ... **Francis A. Packer, Jr.**, NE '51, reports: "I continue my adjunct math professor part-time efforts at Kean College of N.J."

Captain Herbert C. Zitzewitz, SM '34, of Port Republic, Md., died on October 19, 1991. He was a naval architect and marine engineer. Zitzewitz was stationed on the West Coast and served in the Philippines before and during WWII. After retiring from the Navy in 1957, he was a consultant to shipbuilding firms in various locations.

XIV ECONOMICS

Andrew Myers, PhD '90, writes: "I completed my thesis in law and economics in the summer of 1990. I am continuing intensive study of Jewish law. I live in Jerusalem with my wife and daughter—visitors to Israel are welcome to call." ...

Jesus F. Reyes-Heroles, PhD '80, reports: "I am director general of GEO Grupo de Economistas y Asociados, a consulting firm on economic, political, and labor issues in Mexico City. I am also academic coordinator of the Department of Economics of Universidad Iberoamericana." ...

George Galster, PhD '74, of Wooster, Ohio, has cowritten *The Maze of Urban Housing Markets* (University of Chicago, 1991), with **Jerome Rothenberg**, MIT professor of economics, and **Rich Butler**, SM '68, PhD '77. ... **Sadao Nagaoka**, SM '80 (XV), PhD '90, sent word in October from Tokyo: "I am currently director of the Office of Soviet Union and Central & East European Countries, International Trade Policy Bureau, MITI." ... **Steven Peter Zell**, PhD '74, has been

named treasurer of AMC Entertainment, Inc. Previously, he was senior VP and CFO of the Kansas City, Mo.-based company.

XV MANAGEMENT

Paul K. Stedman, SM '89, married Martha Alston Moock on July 6, 1991. In December he accepted a position with Business Systems Group, a consulting firm out of Houston, Texas. ... **Marshall C. Simon**, SM '64, is president of MS Consulting in Fairfield, Conn., a consulting firm concentrating on marketing and market research in the pharmaceutical industry. ... **Donald L. Barefoot**, SM '78, lives in Pittsburgh, Pa., and is president of Chromalox, a division of Emerson Electric. ... **Stuart Grief**, SM '90, sends word from Peabody, Mass.: "I have been with Boston Consulting Group since August, 1990. My wife Amy and I had a daughter, Jordon Rebecca, on July 12, 1990. We are expecting our second child in April 1992."

... **Chris G. Bohrsen**, SM '84, writes: "I'm still in Asia (working as managing director of Teradyne's Asia Operation in Singapore), but I'm now married to **Kathy Kasper Bohrsen**, SM '84. We also have a son, Craig, born on August 21, 1991. Business is booming and thanks to Craig, Kathy and I get no sleep." ... **Mark Heidhorn**, SM '89, was recently promoted to director of business development for PacTel Cellular in Sacramento, Calif. ... **Wendy E. Mackay**, PhD '90, reports: "I've joined Rank Xerox EuroPARC, the European research lab of Xerox PARC in California, which is located in Cambridge, England. I manage a small research group and we're working on developing multi-media distributed networks that support geographically distributed work. A key research goal is to design software that encourages user innovation and is adaptable to local, individual, and group needs."

Dan Deren, SM '74, manager of corporate research systems at Liberty Mutual in Boston, writes: "I have a 10-year-old son, Nathan Daniel. We enjoyed hiking and skiing in the White Mountains of New Hampshire last fall. My wife, Marilyn, trains Hungarian dressage horses. I enjoy living on Cape Ann (almost) on Boston's North Shore, Crane's Beach and sailing on Ipswich Bay. I'm a member of the Ipswich Bay Yacht Club and the Boston Computer Society." ... From Goshen, Conn., **Howard P. Sharp**, '34, sends word that he has now retired. He was formerly with Sharp Management Consultants and a VP for International Tableware Co. Prior to that he was plant manager for the American Chain & Cable Co., in Bridgeport, Conn. ... **David E. Finnell**, SM '87, writes: "I was married in May 1991 to Shari L. Scales, a reporter for the *Indianapolis News*. We honeymooned in Negril, Jamaica, in the West Indies. I was recently elected to the board of trustees of Project Leadership-Service in Indianapolis." ... From Portland, Ore., **Barnaby Sheridan**, SM '84, reports: "Still enjoying life in the great Pacific Northwest. A second daughter, Nina Katherine, arrived on November 15. I'm doing my part to bring Sequent Computer Systems back to profitability." ... **Eric A. Mitchell**, SM '90, sends word that he is manager of the Planning & Analysis Department at Tri Star Pictures in Culver City, Calif. At Tri Star, a subsidiary of Sony Pictures Entertainment, Mitchell has most recently been working on the release of *Hook and Buggy*. ... From Kingwood, Tex., **Hugh H. Fuller**, SM '73, reports: "I recently transferred from Exxon Production Research Co. to Exxon Co. International as manager for natuna gas field development."

MarC H. Meyer, SM '80, PhD '86, and Kathleen Foley Curley were the coauthors of "Putting Expert Systems Technology to Work" in the Winter 1991 issue of *Sloan Management Review*. ... From Palo Alto, Calif., **Tab Bowers**, SM '87, reports that

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III, SM '66
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Dean G. Bostock
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Darlene Vanstone
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Richard Park, Jr., '81
Michael C. Miller, '84
Thomas W. Mullen, '86
Maurice Glucksman, '85
Todd Sjoblom, '75
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he has a new baby boy, Kenji, born on October 6, 1991. . . . From Mexico, **Rodolfo F. Barrera**, '50, writes: "I am chairman of the board of Dirona, S.A., manufacturers of Rockwell axles for heavy trucks and brakes. I am also chair of the board of Fábrica de Tractores Agrícolas, S.A. de C.V., manufacturers of tractors." . . . **Douglas A. Kelly**, SM '79, reports: "I have been at Merganser Capital Management, Inc., in Cambridge for five years as VP for investments. I continue to enjoy my work very much. I have a new son, Ryan, born in August 1990." . . . In Nova Scotia, **John James Kinley**, SM '50, president & treasurer of Lunenburg Foundry & Engineering, Ltd., was elected as a Fellow of the Engineering Institute of Canada for exceptional contributions to engineering in Canada. . . . **Koichi Yamauchi**, SM '88, sends word from Japan: "I am planning to survey and write about 'Japan, Inc., as dangerous Japan Tank' because this country's (unfortunately my home country) economic system is so designed that it has a built-in tendency to deprive ordinary workers of their freedom to live as they wish for the purpose of Japan Tank's militaristic/economic expansion. I will base my argument on statistic data and my working experience, not on my judgment. I will be able to show the dark side of what is often praised by American scholars of management & economics as 'efficient and competitive economic & management systems.' I would like to stress the good side and strength of the American system, too."

Bob Hedges, SM '84, reports from Chicago, Ill.: "Two recent promotions—first, to lead the MAC Group's 30-consultant Chicago office, and second, to head up the MAC Group's Banking Practice. Last November I got to return to Sloan for our annual recruiting presentation. Recently I had the great opportunity to rendezvous with classmate **Phil N. Duff**, SM '84, VP of Morgan Stanley's Banking, Mergers & Acquisitions Group, in New York. We spent a fun evening discussing banking industry restructuring and consolidation." . . . **Atsushi Ogawa**, SM '85, is VP and senior manager of a branch of the Sanwa Bank in Chicago. He was transferred from Tokyo headquarters in July 1991 and belongs to the corporate banking section. . . . From **Suellen Fausel**, SM '86, in Fort Wayne, Ind.: "Our daughter, Chapin Elizabeth, was born August 20, 1991. We are all adjusting to 'life after birth'—Mom is currently on leave from GM, and will probably do part-time work from home via computer for a while. Dad (Chuck) is in his final year of on-campus studies for the Lutheran ministry." . . . From London, **Leon Liebman**, SM '67, writes: "I was elected chair of Financial and Commodity Services, Ltd., and director of M.A.I.D. Systems, Ltd." . . . **Harvey Berger**, SM '76, an attorney and shareholder at Haasis Pope & Correll in San Diego, Calif. writes: "The hard work and stress of being an attorney and helping to manage a 27-lawyer office is greatly overshadowed by the joy and love of my wife, Jan Mulligan, and watching our 3-year-old, Vanessa, growing to learn and love." . . . **Jinsuk Tommy Oh**, SM '84, reports: "I am working in the Hong Kong office of Goldman Sachs as VP in the Investment Banking Division with marketing responsibility for Korea."

Elan Bair, SM '86, has recently joined CSC/Index's Reengineering practice as a managing associate. He and his wife Alma and son, Eric, 4, still live in Medfield, Mass. . . . **Don McNelley**, SM '90, sends word: "Hilary and I gave birth on October 13, 1991, to our daughter, Catherine Sanders McNelley. We moved to Oakland, Calif., last June where I am working as a finance consultant at Accountants 4-Contract. Previously, we had been living in Cambridge, where I worked as a securities analyst." . . . **David Ryder**, SM '84, sends word from Westbury, N.Y., where he is director of business development at Lex Electronics: "I recently returned from a year in Europe, based in London. I was transferred to develop a business strategy and operational

changes for our European electronics distribution businesses. A single European market is approaching but at a slower rate than most of us would like to believe. Our children are already 2 and 6 years old. I hope to hear from my fellow alumnae/a." . . . From Madrid, **Antonio Bonet Madurga**, SM '89, reports: "Our three kids are, finally, going to school. Coqui has started a textile design company, which is going fine. My companies, Eurotandem (a corporate finance boutique), and Ace (a project and export finance consultant), are going well. I intend to dedicate some time this year to set up a Sloan Alumni/ae Club in Spain." . . . **Laurence B. Timm**, SM '83, writes: "Casey and I got married in August 1990 and are expecting our first two-legged cash drain in April of 1992. I am working with Athens Corp., an innovative start-up in San Diego. Our primary products are sulfuric and hydrofluoric acid reproducers for the semiconductor industry. The machines increase device yields, decrease acid usage by more than 95%, and make our industry that much kinder to the environment."

Bruce D. Temkin, SM '89 and **Karen (Katz) Temkin**, SM '89, were married in December 1990. . . . From San Diego, **Elizabeth Coley**, SM '87, writes: "My boss and I were recently promoted! As the assistant to the COO at UCSD Medical Center I have fingers in many pies—budget development, quality management, utilization management, licensing, accreditation, and miscellaneous other projects. It keeps me busy!" . . . **Giyora Doeh**, SM '58, sends word from Los Angeles, where he is president of West LA Realty: "I'm still operating an independent full-line real estate office, including residential homes, condos, apartments, commercial sales and leasing, business opportunities, nationwide referral service, and agent training for productivity. My daughter in Durango, Colo., has recently awarded me status of second-time grandfather; my son in Hawaii did the honor for first-time." . . . **Carl Albrecht**, SM '90, is an associate at Booz Allen in San Francisco. He and his wife Mollie announce the birth of Lily Isabel Albrecht, on October 18, 1991. . . . **John A. Myer**, SM '80, writes: "In addition to my corporate staff duties at Arthur D. Little, I am teaching a course in quantitative methods at the Management Education Institute, ADL's own business school." . . . **Philip A. Stevens**, SM '58, is director of Stevens Consulting in Tiffin, Ohio. In May 1991 he was elected chair of the board of directors of Vision Service Plan, Northeast Region. He has served on this board since 1984. . . . **Sadao Nagaoka**, SM '80, PhD '90 (XIV), sent word in October from Tokyo: "I am currently director of the Office of Soviet Union and Central & East European Countries, International Trade Policy Bureau, MITI."

John Roberts, SM '82, PhD '84, sends word: "I am an associate professor at the Australia Graduate School of Management. I have recently cowritten book chapters on marketing models in the *TIMS Handbook on Marketing Science and Marketing Models*. I have forthcoming articles in the *Journal of Marketing Research and Research Policy*." . . . **Mary Cross**, SM '80, writes: "Jack Salerno, PhD '83 (III), and I are pleased to announce the births of Katie and Julie on August 12, 1991. They join Jennifer, 3. Jack is VP at Kopin Corp. in Taunton, Mass., and I am a senior product manager at BBN Software in Cambridge." . . . **Paul R. Jandreau-Smith**, SM '86, was promoted to VP at Young & Rubicam's Direct Marketing Agency Wunderman Worldwide. . . . **Enrico C. Perotti**, PhD '90, is visiting the Financial Market Group at the London School of Economics in England on a grant from the European Commission. Perotti is an assistant professor of finance at the Graduate School of Management at Boston University. . . . **Lawrence S. Daniels**, SM '66, has been named VP for marketing & business development at Biogen, Inc., in Cambridge. Previously he was staff VP for corporate strategy

at Allied-Signal Corp. in Morristown, N.J. . . . **Ann L. Eckert**, SM '81, is director of marketing for Candela Laser Corp. in Wayland, Mass. Previously she worked as a senior product manager for the Boston-based Kendall Co. . . . **Yuval Almog**, SM '79, managing partner at IAI Venture Capital Group in Minneapolis, Minn., has been named to the board of directors of Delphi Information Systems, Inc., in Westlake Village, Calif. . . . **Alan N. Gamse**, '64, was recently appointed to the Council of the Tort and Insurance Practice Section of the American Bar Association. He was also appointed as chair of the Tort and Insurance Practice Section's Information Exchange Task Force. Gamse is a partner in the law firm of Semmes, Bowen & Semmes.

Sloan Fellows

Robert P. Clagett, SM '67, writes: "After five years as dean of the College of Business at the University of Rhode Island, I stepped down to become a lecturer in the Management Department. I now teach graduate courses in management of technology. My wife and I have sailed our 34-foot cutter to Maine for five weeks the past two summers." . . . From Denver, Colo., **Linda Laskowski**, SM '84, reports: "I have been named CEO of CLM Associates, a joint-venture between USWest Communications and France Telecom. This venture will own and market online electronic service gateways in Omaha, Minneapolis-St. Paul, Seattle, and future sites." . . . **David S. Greenlaw**, SM '57, sends word from Norway, Maine: "I retired as VP from Eastman Kodak Co. in 1955. I then started Great Boarstone Co. to provide management services: corporate strategy, corporate organization, and corporate culture with emphasis on quality, productivity, and corporate mental health." . . . **Richard G. Rhoades**, SM '77, who is associate director for systems of the U.S. Army Missile Command in Redstone Arsenal, Ala., reports: "I had an interesting special assignment last winter and spring leading a team in Washington planning for strategic downsizing of Army Materiel Command. Interesting, but not nearly as much fun as planning for growth. I was also lucky enough to receive my third presidential rank award this year—helps toward tuition payments. Most important, Dale and I became grandparents for the first time."

From Port Washington, N.Y., **Gary E. Frashier**, SM '70, writes: "My company, Oncogene Science, is developing new drugs to treat human cancer based on oncogene and anti-oncogene proprietary technology, which is also being used to develop new diagnostic tests for cancer. The company just completed raising \$20 million in new funds in a secondary offering and has major research collaborations with Pfizer and Becton-Dickinson, Inc." . . . **William F. Spence**, SM '72, sends word: "My wife and I arrived in Hong Kong in June 1990, to take up residence. My new posting entails looking after the Canadian Imperial Bank of Commerce's interests in Asia. This is a very interesting and dynamic part of the world and we enjoy it immensely." . . . **John R. Smart**, SM '77, has been named senior VP for International Public Affairs at AT&T. Previously, he held the post of president of Business Communication Services at the Basking Ridge, N.J.-based company. . . . **Robert N. Pratt**, SM '69, is president & COO of Alta Gold Co. in Salt Lake City. Previously he was a chief consultant with Bonneville Pacific Corp., also based in Salt Lake City. . . . **Robert F. Calman**, SM '67, adds the title of CEO to his existing responsibilities as chair of Echo Bay Mines Limited in Philadelphia.

Senior Executives

Asad M. Madni, '90, writes: "I am currently serving in the capacity of chairman of the board, president, and CEO for Systron Donner Corp., a Thorn/EMI Co., based in Sylmar, Calif. My cur-

rent focus is on strategic planning and positioning of the Instrument & Microwave Divisions under the present defense budget environment. I was also elected as the 1991-92 vice-chairman of the IEEE-MTTT San Fernando Valley Chapter." . . . **Hideshi Iwata**, '88, was promoted to senior managing director at DaiNippon Ink & Chemicals, Inc., in Tokyo, last June. . . . **William O. Rentz**, '80, sends word from Marietta, Ga.: "I am a senior consultant in the Nuclear Maintenance Division at the United Energy Services Corp. I'm presently at the Oak Ridge, Tenn., K-25 site, formerly the gaseous diffusion enrichment plant, acting as a consultant to the site manager." . . . **Anthony Bassioudis**, '89, has been named executive VP of Alpha Techniki, a construction company, headquartered in Athens, Greece. . . . **Harry P. Kamen**, '82, has been named senior executive VP at Metropolitan Life Insurance Co. Previously he was executive VP & general counsel for the New York City-based company. . . . **Richard Dulude**, '69, vice chair of Corning, Inc., in Corning N.Y., has been named to the board of directors at Raychem Corp. in Menlo Park, Calif., and at Grumman Corp. in Bethpage, N.Y. . . . **James E. McCormick**, '68, president and COO of Oryx Energy Co., in Dallas, is on the board of directors at Lone Star Technologies, Inc., also in Dallas.

The Alumni/ae Association has been notified that **Frederik O. Jeppesen**, '64, of Denmark, died on April 23, 1991. There was no further information provided.

Management of Technology Program

John P. Kindinger, SM '85, reports that business is good at PLG, and he is looking forward to meeting the '91 class during its field trip. John and his family have recently moved into a new house, as well. . . . **Jack Jarkvik**, SM '86, is president of his own consulting firm, Jack Jarkvik Management AB in Sweden. He works as a trouble shooter for large projects, in and out of Sweden. He recently had a 10-week assignment in Britain and a 5-week assignment in Canada. . . . **Richard P. Percoski**, SM '86, is department manager of Advanced Programs at Lockheed Sanders in Nashua, N.H. . . . **Neil Slavbin**, SM '87, is executive VP for Intelligent Energy Systems, Inc. He says that he "spent the last year as a founder of a start-up developing residential cogeneration systems" and that "it has put all my MOT experience to very good use." . . . **Rob Capell**, SM '88, has a new position as assistant VP for business services in BellSouth Telecommunications' Marketing Department. He has retained responsibility for national services coordination and picked up responsibility for product development and product management for the business market. . . . **Kathy Kessel**, SM '88, has sold her house in Sharon and is building a new home on Carding Mill Pond in Sudbury, Mass., near the Wayland Inn. . . . **Dean Jaumseil**, SM '88, was recently promoted to chief engineer of the Mechanical Engineering Department at Ingersoll Milling Machine Co. . . . **Lisa Frydenlund**, SM '90, is director of strategic planning at ICI Acrylics, Inc., in St. Louis, Mo.

Tom Eccles, SM '90, was selected for promotion to the rank of lieutenant commander in the U.S. Navy. . . . **Youichi Ohshima**, SM '90, and his wife, Mie, had a daughter named Nagisa last summer. Youichi has co-written a new book on waterfront development strategy. . . . **Tom Greaves**, SM '90, reports in a letter to Professor **Ed Roberts**, '57, SM '58 (VI), SM '68 (XV), PhD '62 (XIV), that after only six months with Daratech, Inc., of Cambridge, Mass., he is now VP, an officer of the company, and sitting on the board. "Accepting a new position with Daratech was a major career change for me, one that has been most rewarding and one that would not have been possible without the MOT experience." . . . **Mathias G. Kothe**, SM '90, has been promoted to head of strategic

planning at Siemens Solar. Mathias is "happy being in an industry at the very core of environmentally benign technology." . . . **Barbara Proud**, SM '90, came by to visit. She was here to spend the holidays with her son, Trevor, who is a sophomore at Berklee School of Music. She planned to visit the Blanchards in Vermont and do some skiing. Barbara reports that Hong Kong is wonderful, and she is very busy at work on a project to implement a hospital information system involving 37 hospitals. The goal is to build a national patient master index for Hong Kong. She helped to host a visit to Hong Kong's Hospital Authority by University of Toronto MBA students on their Asian Study Tour.

Tom Heller, SM '91, is the president and CEO of his new company, Total Quality Asset Management, in Lincoln, Mass. The firm makes equity investments in companies which practice total quality management. Tom is also a registered investment advisor for pension fund assets. . . . **Soo Sheung Wong**, SM '91, has been working on a major project for the Pareto client managing the Bourdeny Bay International Airport. Soo Sheung has been brought in to reorganize the management structure, policies, procedures, and operating systems at the airport. "Those trips to Hughes Aircraft sure came in handy!" She also reports that **Mark Taylor**, SM '91, and friends will be coming to Vancouver for a ski weekend and a visit. . . . The aforementioned **Mark Taylor**, is technology portfolio manager at Corning Asahi Video. An unofficial MOT '91 dinner, hosted by **Naoki Yamamoto**, SM '91, of Hitachi and **Hirokyu Akiyama**, SM '91, of Fuji Xerox, was held in Tokyo on October 9, 1991, to welcome Mark to Japan. The opening speech was given by **Naoki Kato**, SM '91, of NTT and speeches were also given by **Masaya Watanabe**, SM '91, of Hitachi and **Shoichiro Norburi**, SM '91, of Mitsubishi Heavy Industries. Mark also visited classmates **Hisao Inagaki**, SM '91, of the Japanese Foreign Ministry and **Yoichi Sakamoto**, SM '91, of Matsushita. . . . **Hai-Den Wu**, SM '91, is chief staff of the Manufacturing Division at Chung Chang Institute of Science and Technology in Taiwan. Recently he has been working on the organization restructuring program and serving as a part-time assistant to the company CEO for strategy formulation. He wrote, "Thanks to MOT!!" for giving him the foundation for his current assignments.—Fay Wallstrom, Management of Technology Program, MIT, E56-304, Cambridge, MA 02139.

XVI AERONAUTICS AND ASTRONAUTICS

From North Andover, Mass., **Robert E. Ricles**, '59, writes: "I received a Juris Doctorate from the Massachusetts School of Law in June 1991. I received a double major in business & corporate law and real estate law." . . . **Paul V. Osburn**, SM '59, ScD '62, reports that he is "double retired and enjoying golf and grandfathering." . . . From Beavercreek, Ohio, **Jim Blissit**, SM '86, sends word: "We closed an F-16 wing in Germany after the unification of Germany and the withdrawal of the Soviets from Eastern Europe. I was selected to be an acquisition manager for the Air Force's Advance Tactical Fighter (F-22) at the Aeronautical Systems Division in Ohio." . . . **Harry Sauerwein, Jr.**, SM '60, ScD '64, writes: "I am now with Booz Allen & Hamilton heading a group working on the Strategic Defense Initiative." . . . **Peter M. Bainum**, SM '60, reports: "I was the recipient of the American Astronautical Society's Dirk Brouwer Award for contributions in space-flight mechanics and astronautics in November 1990. I was reelected VP of AAS International last fall and served as IAF Astrodynamics TC chair form 1987-91." . . . **Ronald E. Stauffer**, '70, has been appointed chair-elect of the Employee Benefits Committee of the Tort and Insurance

Practice Section of the American Bar Association. He previously served as chair of the Tort and Insurance Practice Section's Subcommittee on ERISA legislation. Stauffer is a partner in the law firm of Sonnenschein, Nath & Rosenthal in Washington, D.C.

XVII POLITICAL SCIENCE

From Durham, N.H., **Paul Josephson**, PhD '87, writes: "My book *Physics and Politics in Revolutionary Russia* (University of California Press) was published last fall. I am currently on leave from Sarah Lawrence College in Bronxville, N.Y., at work on a history of postwar Soviet nuclear and high-energy physics. I will be in the former Soviet Union on a Fulbright for three months this year. I miss softball, my colleagues, and most of all, the Muddy Charles Pub at MIT." . . . **Candace A. Roper**, SM '85, reports: "I am a senior international economist specializing in country risk assessment at CoBank in Denver, Colo. Before joining CoBank in 1990, I managed the country risk assessment area at Bank of New England (now Fleet Bank) in Boston." . . . **Jim MacNeill**, Pieter Winsemius, and **Taizo Yakushiji**, PhD '77, are the authors of *Beyond Interdependence: The Meshing of the World's Economy and the Earth's Ecology* (Oxford University Press, 1991). Yakushiji is a professor of technology and international relations at the Graduate School of Policy Science at Saitama University in Japan.

XVIII MATHEMATICS

The Societal Institute for Mathematical Sciences (SIMS) in New Canaan, Conn., has received a major grant for research in AIDS statistics from

the National Institute on Drug Abuse. The award, which will total more than \$611,000 in the first year and more than \$3 million over four years, will fund international research on the statistical methodology for study of the AIDS epidemic. Specifically, research will focus on developing methods for maximizing the information that can be derived from AIDS statistics, particularly those



D.L. Thomsen

related to drug abuse. SIMS President **Donald L. Thomsen, Jr.**, PhD '47, will serve as principal investigator for the research project. The research will be conducted at five institutions, including the New York University Medical Center, the Universities of California at San Francisco and Berkeley, the University of Waterloo in Ontario, and the University of Tuebingen in Germany. SIMS was founded in 1973 to "foster the application of mathematics to society problems," states a company press release. . . . **Eric Reissner**, PhD '38, professor emeritus of applied mechanics at the University of California at San Diego, has been named an honorary member of ASME. Such membership is given for lifetime service to engineering. Reissner is receiving the award for "his profound and lasting mark on international applied mechanics through over a half century of teaching, 300 research papers, and wise counsel at the highest levels of ASME." Reissner began his career at MIT in 1937 and for 32 years held several positions, most as professor of mathematics. In 1970 he began his work at the UC/San Diego.

XX APPLIED BIOLOGICAL SCIENCES

Carlos Thompson, SM '74, of Greenville, N.C., died of kidney failure and cancer at age 49 on July 3, 1990. He received an associate degree in applied science in electronic engineering technology in June 1989 from Nash Community College in Rock Mount, N.C. Thompson had received a kidney transplant in 1982.

XXI HUMANITIES

Gergory A. Jackson, '70, has been appointed the first director of academic computing at MIT. Jackson will be the principal advocate for academic computing at the Institute and will oversee coordination of the delivery of academic computing services. For the past two years Jackson has been director of educational studies and special projects in the Office of the Dean for Undergraduate Education.

XXII NUCLEAR ENGINEERING

Andrew G. Cook, SM '76, NUE '76, PhD '78, writes: "I just left my position as Total Quality manager of the Westinghouse Nuclear Services Division to become a regional VP for ABB and I love it!" . . . **David J. Diamond**, PhD '68, sends word: "I'm still doing reactor safety analysis at Brookhaven National Lab as an outside consultant. Assignments last year included a week at the International Atomic Energy Agency in Vienna, six weeks at the Paul Scherrer Institute in Switzerland, and a continuing project with the Atomic Energy Control Board in Canada." . . . **Suzanne F. Shedd**, SM '86, reports: "I received

my PhD in biomedical engineering from Duke University in May 1991. I am presently at the German Cancer Research Center in Heidelberg, where I am using magnetic resonance spectroscopy to characterize the effect of chemotherapeutic agents on phospholipid metabolism in human tumor cells. My husband, **Gordon M. Shedd**, SM '86, also received his PhD last May (in materials science from North Carolina State University). He is now exploring methods to create highly coherent, low-energy electron beams for applications in electron microscopy and holography (e.g. biological molecules) at IBM's Zurich Research Lab."

From Madrid, Spain, **J.L. del Valle Doblado**, SM '78, NUE '78, sends word: "I was promoted to director general adjunto of Banco Central, S. A., in charge of investment banking and international capital markets." . . . **Achilles G. Adamantiades**, PhD '66, writes: "I have directed my attention to the problems of nuclear safety in Central and Eastern European countries. Several units of the early VVER-440 model 230 Soviet-designed reactor exist in Czechoslovakia, Bulgaria, and the former Soviet Union. Their design is deficient in many respects. In addition, the training of operators, safety procedures, and general safety culture is below acceptable levels. The World Bank is exploring means to help ameliorate the situation." . . . **J.H. Goldberg**, SM '60, lives in Jupiter, Fla., and is president of the Nuclear Division of the Florida Power & Light Co. . . . From **Dennis R. Spurgeon**, SM '69, NUE '69, in Potomac, Md.: "I have been reelected chairman and CEO of Swiftships, Inc., an international builder of patrol boats, mine warfare vessels and luxury yachts. Simultaneously, Swiftships announced that it has received a \$115-million contract with the government of Egypt to build coastal minehunters." . . . **Michael V. McMahon**, SM '90, sends word from Groton, Conn.: "I am a reactor controls officer on board the nuclear fast attack submarine USS *Pittsburgh*. I married the former Janice Onanian, '89, SM '89 (VI), on June 2, 1991, in Cambridge."

TPP TECHNOLOGY & POLICY, PROGRAM

Richard Kutta, SM '80, has an addition to his family—Evan arrived in August 1991. Older brother Andrew is now five. As of January 1, 1992, Dick will become the director of public works for St. Louis County. . . . **Daniel R. Saltzman**, SM '80, has been appointed chair of the board at Portland Community College in Portland, Ore. . . . **Jean-Bernard M. Caen**, SM '81, writes: "I have started my own finance and technology management consulting company in 1991. Our goal is to provide support to banks, financial institutions, and insurance companies as to how to use technological tools for the greatest benefits of the company and its customers. Specific missions have included the selection of a trading system, a market study for a private fund index, or the assessment of a development program to increase market share by using new information technologies. Before 1991 I headed development of software sales in the Financial Sector for Comshare, Inc., in France." . . . **Rizwan Ibrahim**, SM '86, and his wife, Amma, had a daughter join their family in 1990. . . . **Alice B. Outwater**, SM '87, had her first son, Samuel Outwater Lang, early last June after moving to a farm in Vermont. She was stunned to find infant care much more demanding than an MIT master's. . . . **Isna M. Soedjatmoko**, SM '87, recently joined Mobil Oil Indonesia, Inc., as an environmental advisor. So far, there's no objection from her four-month-old daughter.

Sylvia Marin-von Koller, SM '88, is working as the assistant regional coordinator of the Environment Project for Central America or Proyecto Ambiental para Centro America, PACA. This project is a joint venture between CARE and

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Continued from Page MIT 47

pitching the diamond and spade losers. (2) On the fourth heart, discard a low club, cash the spade jack and 6, discarding two low clubs, cash the diamond king, cross to dummy with the diamond ace, and take the ace of clubs, pitching the diamond loser. (3) On the fourth heart, discard a low club, play the diamond 4 to dummy's diamond ace, pitch the spade 6 on dummy's ace of clubs, then lead back the (well preserved) three of diamonds, finessing East's jack.

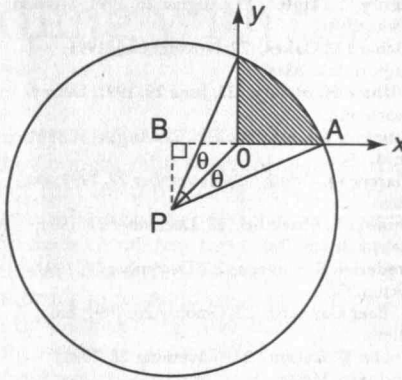
N/D 2. Matthew Fountain wants to know how large is the volume that lies within two inches of all the corners of a two-inch cube. All the volume must lie within two inches of all the corners.

John Salmon notes that this problem was solved in his thesis, which I happen to know involves a very sophisticated solution technique for hierarchical N-body problems. Indeed, the required formula is actually a numbered equation (6.8). The solution below is from Eugene Sard:

It is convenient to use a rectangular coordinate system with x -, y -, and z -axes parallel to the cube faces, and whose origin is at the center of the cube. The 8 cube corners are then at the 8 arrangements of $(\pm 1, \pm 1, \pm 1)$. The distance of the origin from each corner is $(1^2+1^2+1^2)^{1/2}=3^{1/2}$ and the volume in question is a small symmetrical 8-surface "nut" around the origin. Each of the 8 surfaces subtends a solid angle of $\pi/2$ between x -, y -, and z -planes.

Consider the surface where x , y , and z are all positive. Each point on this surface is 2 inches from the corner at $(-1, -1, -1)$, or $((x+1)^2+(y+1)^2+(z+1)^2)^{1/2}=2$. Recasting for a fixed z gives a

boundary equation of a circle in an x - y plane, $(x+1)^2+(y+1)^2=4-(z+1)^2$, with center $P(-1, -1)$ and radius $PA=(4-(z+1)^2)^{1/2}$.



The complete shaded area of interest is also bounded by the lines $x=0$ and $y=0$. Other key dimensions are $PB=OB=1$, $OP=2^{1/2}$, and $OA=AB=OB=(3-(z+1)^2)^{1/2}-1$. From the law of cosines, $\text{angle } \theta = \arccos((1+(3-(z+1)^2)^{1/2})/(2(4-(z+1)^2)^{1/2}))$. Thus 2θ varies from $.33984$ to 0 rad. as z varies from 0 to $2^{1/2}-1$. The shaded area is the difference between the full sector area and twice the area of triangle OAP , or $A=\theta(4-(z+1)^2)-\sin\theta(2(4-(z+1)^2)^{1/2})$. Finally the "nut" volume, $V=\int_0^{2^{1/2}-1} A dz$. Numerical integration gives $V=.121644$ cubic inches to 6 significant figures.

N/D 3. Robert Sackheim notes that all readers know that if a man leaves home, walks a mile south, then walks a mile west, shoots a bear, then walks a mile north and finds himself back

home, that the bear is white because the man's home is at the North Pole and the bear is a polar bear. Sackheim wonders if there is any other place on earth where a person can go a mile south, then a mile west, then a mile north and be back at the starting point?

The answer is clearly yes, there are an infinite number of solutions near the South Pole. Several readers pointed out that no bears will be found. The following solution is from Jack Bross:

There are an infinite number of latitudes from which one may go 1 mile south, 1 mile west, 1 mile north, and find oneself back where one started: all of them are slightly more than a mile away from the South Pole (accumulating on the circle 1 mile from the pole). The idea is that if going one mile south brings you near the pole, west will circle around the pole several times. For any n , we can find a distance so that one mile wraps exactly n times around the pole. Then, north will take us back to where we started. The actual values depend on one's assumption about the curvature of the earth near the pole, but of course the earth is fairly flat at a distance of one mile, so they are well approximated by $1+1/2\pi n$ miles.

Other Responders

Responses have also been received from E. Biek, W. DeHart, M. Deskey, S. Feldman, M. Fountain, D. Fraser, N. Gevirtz, C. Keavney, K. Kiesel, M. Lindenberg, A. Ornstein, W. Pulver, A. Reed, K. Rosato, P. Sanchez, R. Schweiker, A. Silva, D. Smith, J. Uretsky, D. Wachsman, C. Whittle, J. Wilson, J. Woolston, H. Zaremba.

Proposer's Solution to Speed Problem

All three are the same.

the Nature Conservancy and the objective is to improve the management of natural resources throughout Central America while promoting sustainable development projects. PACA is working in Belize, Guatemala, Honduras, El Salvador, Nicaragua, and Costa Rica. The project consists of four technical components: wildland management, environmental education, conservation information, and strategic planning. . . . **Gregg F. Martin**, SM '88, has mentioned that the College of Naval Command and Staff is outstanding. There are only 200 students—100 Naval officers, 34 Army, 30 Air Force, 25 Marine, and the remainder Coast Guard and civilians. The orientation is on joint military operations, strategy, and national policy. So far they have analyzed historical military case studies ranging from antiquity to modern times. . . . **Marina Skumanich**, SM '88, has joined Battelle's Environmental Policy and Social Research Center as a research associate. . . . **Simon Stokes**, SM '88, is working for a patent and corporate law firm in London. He expects to qualify as a solicitor in 1992. After Christmas he hopes to take a part-time course in European law at King's College in London. . . . We have heard that **Terry Turnipseed**, SM '88, has married a redheaded nurse.

Jennifer Croissant, SM '89, taught "Women in Science and Engineering" at Rensselaer High School Summer Program. She also completed her qualifying and dissertation exams in the Science and Technology Studies doctoral program at Rensselaer. . . . **Jeff Dieffenbach**, SM '89, is currently a project manager at IBIS Associates, an engineering consulting firm in Wellesley, Mass. He is also working on issues for the Paul Tsongas for President Campaign. . . . **Aaron "Todd" Curtis**, SM '90, is on staff at the Boeing Commercial Airplane Group in Seattle, Wash., as

a safety systems engineer. . . . **Mark Roberts**, SM '90, has been in Washington, D.C., for a year now, working at the Congressional Office of Technology Assessment. He has found a great number of TPP alumni/ae at OTA. He is currently working on a study of defense conversion beating missiles into microwave ovens. . . . **James "Jamie" Winebrake**, SM '90, is presently working on a PhD at the University of Pennsylvania's Center for Energy and the Environment. . . . **Paul Chan**, SM '91, has joined the staff of Koenenman Capital Management, Pte. Ltd., which is an international investment firm based in Singapore. The firm was started by two MIT alumni. Paul is currently working on a data visualization project which he finds both interesting and challenging.—**Réné Smith** for Richard de Neufville, Technology and Policy Program, MIT, Rm. E40-252, Cambridge, MA 02139.

STS PROGRAM IN SCIENCE, TECHNOLOGY & SOCIETY

Professor **Jill Conway** gave a talk about Australian history entitled "Fatal Shore or Luck Country" last December at the Smithsonian Institution. . . . Professor **Deborah Fitzgerald** is editing a new series, *Revisiting Rural America*, for The Johns Hopkins University Press. . . . Professor **Loren Graham** delivered the keynote address at the joint meeting of the Society for the History of Technology and the History of Science Association in Madison, Wisc., last November. He and Professor **Eugene Skolnikoff**, '49, SM '50 (VI), PhD '65 (XVII), traveled in early December to Moscow to speak to leaders of the Soviet and Russian Academies of Science about the restructuring of Soviet and Russian science. . . . Professor

Lily Kay presented a paper on the technological roots of early molecular biology at the 1991 4S meeting. She is spending the spring term at the Max Planck Institute for Physical Chemistry in Göttingen. . . . Professor emeritus **Leo Marx** gave a talk in Sharon, N.H., entitled "Henry Thoreau and the Humanistic Perspective on Environmental Degradation." . . . Professor **Leon Trilling** presented a paper on engineering education and international perspectives at the seventh IEEE Careers Conference in Denver last October.

The following are STS graduate student notations. **Bruce Bimber** delivered a paper, "The Politics of Expertise and the Separation of Powers" at the annual American Political Science Association meeting in Washington last September. . . . **Dan Grossman**, '82 (VIII), SM '86 (XVII), and Seth Shulman were the coauthors of "Over There: The U.S. Military's Toxic Reach," in the November 28, 1992, issue of *Rolling Stone*. . . . **David Mindell** went to the Galapagos Islands in November and December as part of the Jason Project, an educational program aimed at getting secondary school students interested in science and technology. Mindell is control system engineer and navigator for this year's project, having developed the undersea robot "Jason Junior" in his work at the Woods Hole Oceanographic Institute.—**Phyllis Klein**, STS Program, MIT, E51-128, Cambridge, MA 02139.

Deceased

The following deaths have been reported to the Alumni/ae Association since the *Review* last went to press:

L.G. Lee Thomas, '20; November 22, 1991; Naples, Fla.

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Warren K. Brimblecom, '21; December 18, 1991; South Yarmouth, Mass.

Thomas B. Davis, '21; September 20, 1991; Memphis, Tex.

Irving D. Jakobsen, '21; October 21, 1991; Bayville, N.Y.

Henry C. Taintor, '21; August 25, 1991; Mission Viejo, Calif.

Richard B. Oakes, '22; November 4, 1991; Auburndale, Mass.

William H. Blandy, '23; June 29, 1991; Delray Beach, Fla.

Laurence Edmund Noble, '23; August 9, 1991; Enid, Okla.

Clarence J. Odell, '23; November 27, 1991; Lee, Mass.

Dunbar L. Shanklin, '23; December 21, 1991; Delray Beach, Fla.

Frederick B. Stevens, '23; December 17, 1991; Akron, Ohio

G. Baer Connard, '25; October 26, 1991; Bath, Maine

Robert B. Hatton, '25; November 26, 1991; Andover, Mass.

Jesse L. Maury, '25; April 4, 1991; Arlington, Va.

William R. Wheeler, '25; November 2, 1991; Southbury, Conn.

Reginald Frank Terrill, '26; November 14, 1991; Concord, N.H.

Samuel S. Auchincloss, '27; November 5, 1991; Englewood, Fla.

Edward R. Coop, '27; December 15, 1991; Rumford, R.I.

David R. Knox, '27; November 25, 1991; Lantana, Fla.

Thomas F. Russell, '27; July 6, 1991; Naples, Fla.

Warren Grier Armstrong, '28; October 26, 1991; Newark, Del.

Robert F. Schuler, '28; December 16, 1991; Newton Centre, Mass.

Milton H. Clapp, '29; December 1, 1991; Edgecomb, Maine

Ruth C. Dean, '29; November 13, 1991; Wellesley, Mass.

John J. Jarosh, '30; December 1, 1991; Wilmington, Calif.

Stanley G. Russell, '30; October 16, 1991; Annisquam, Mass.

Willard W. Selden, '30; November 29, 1991; Ludlow, Mass.

David Nicoll, '31; November 16, 1991; La Jolla, Calif.

Max Katz, '32; January 7, 1992; Topsfield, Mass.

Richard A. Lobban, '32; December 10, 1991; Haverford, Pa.

Halsted R. Warrick, '32; August 30, 1991; Hendersonville, N.C.

John C. Herbert, '33; October 29, 1991; Erie, Pa.

Eugene Rohman, '33; November 25, 1991; West Hartford, Conn.

Frank R. Milliken, '34; December 4, 1991; Tucson, Ariz.

John M. Thompson, '34; March 2, 1991; Rye, N.Y.

W. Olmstead Wright, '34; August 26, 1991; Lombard, Ill.

Herbert C. Zitzewitz, '34; October 19, 1991; Port Republic, Md.

Arthur M. King, '35; August 13, 1991; Louisville, Ky.

John Ayer, Jr., '36; November 13, 1991; Denver, Colo.

D. Elliot Cullaty, '36; June 9, 1988; Weston, Mass.

William A. Healy, '36; November 26, 1991; Concord, N.H.

Merwin Miller, '36; October 4, 1991; Berkeley, Calif.

Samuel Norton Miner, '36; December 8, 1991; Lakeville, Conn.

Carl M. Peterson, '36; October 3, 1991; Pittsburgh, Pa.

Edward M. Fischer, '37; October 22, 1991; Olathe, Kan.

Robert Nedbor, '37; June 18, 1991; Plantation, Fla.

William C. Wold, '37; October 19, 1991; Dover,

N.H.

George F. Wollinger, Jr., '37; November 19, 1991; Laguna Hills, Calif.

Murray H. Hayward, '38; November 13, 1991; Troy, Mich.

Louis B. Tura, '40; December 28, 1991; Chatham, Mass.

Marion Loren Wood, '40; October 3, 1991; Briarcliff, N.Y.

Lawrence E. Beckley, '42; December 30, 1991; Winchester, Mass.

Donald Stein, '42; October 13, 1991; Falls Church, Va.

Marvin N. Stein, '42; November 1, 1991; Brewster, Mass.

David J. Crawford, '43; April 15, 1991; Poughkeepsie, N.Y.

Jonathan H. Sprague Jr., '43; October 2, 1991; Houston, Tex.

Katherine A. Kulmala, '44; January 5, 1992; Carlisle, Mass.

Keith W. Cramblet, '45; March 20, 1990; Santa Ana, Calif.

Richard S. Bettes, Jr., '44; August 17, 1990; Mountain Lakes, N.J.

George K. Landon, Jr., '45; November 18, 1991; Edmund L. Czapek, '46; October 31, 1991; Quaker Hill, Conn.

John M. McMillin, Jr., '46; July 20, 1991; Cincinnati, Ohio

John M. De Bell, Jr., '47; December 14, 1991; Toms River, N.J.

R. Ellsworth Annis, Jr., '48; August 17, 1991; West Yarmouth, Mass.

Roy Oringer, '48; November 16, 1991; Quincy, Mass.

Robert H. Ruth, '49; October 4, 1991; Lodi, N.Y.

Paul E. Weamer, '49; December 5, 1991; Chesterfield, Mo.

Maurice C.M. Grandpierre, '50; September 5, 1991; Nancy, France

Frederic D. Grant, '50; November 11, 1991; Wellesley Hills, Mass.

Yaichi Ayukawa, '52; November 30, 1991; Tokyo, Japan

Albert L. McManus, Jr., '52; November 3, 1991; Framingham, Mass.

Paul C. Watson, '52; December 25, 1991; Davis, Calif.

Kjell Loevaas, '53; July 14, 1991; Oslo, Norway

Gerald P. Richards, '53; November 18, 1991; Framingham, Mass.

Roswell L. Derby, '54; November 7, 1991; Longmeadow, Mass.

Domenic B. Vassallo, '56; November 26, 1991; Bethesda, Md.

George W. Walsh, III, '57; October 10, 1991; Durham, N.C.

Larry G. Glassmaker, '58; September 29, 1991; Palo Verde Pen, Calif.

Franklin W. Mohnney, '61; May 2, 1991; New York, N.Y.

Ralph J. Bahnsen, '65; June 16, 1991; Wappingers Falls, N.Y.

Preston G. Pollock, Jr., '67; November 27, 1991; Cruz Bay, St. John, U.S.V.I.

Merrill L. Andrews, '68; August 23, 1991; Beavercreek, Ohio

John E. Litt, '70; November 1, 1991; Mountain View, Calif.

John Chaiken, '71; December 4, 1991; William K. Kietrich, '71; September 4, 1991; Houston, Tex.

Charles F. Scott, Jr., '73; November 4, 1991; Boston, Mass.

Carlos Thompson, '74; July 3, 1990; Greenville, N.C.

Kenneth R. Gobeille, '81; August 31, 1991; Montreal, Quebec, Canada

Gregory O. Tomlinson, '81; November 8, 1991; Boston, Mass.

Douglas K. Tannatt, '87; October 19, 1991; Philadelphia, Pa.

Fiddling with the Roof

Mary Lindenberg reports that her husband Martin, when interviewing high school students applying to MIT, always encourages them to take advantage of sailing the Tech dinghies. Mary usually shows them "Puzzle Corner" and points out an interesting problem. Martin includes comments in his report if they solve the problem.

It has been at least a year since I specified the size of the backlogs for the various kinds of problems that are printed. Let me do so now. When the size of the column was reduced and the number of regular and speed problems per issue halved, the backlog had an instantaneous doubling (measured in months, not letters). I now have nearly 2 years worth of speed problems and even more for regular problems. However, I have very few of the special (chess, bridge, computer, go) problems. So if you have any of these special problems, send them in. If not, I may soon just merge the special with the regular problems and print three from the combined list each issue instead of the current 1 special, 2 regular policy.

Problems

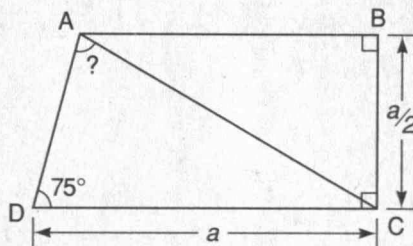
APR 1. A wild one from Jorgen Harmse. White is to move and mate in 12.

		R			
					B
			P		
P	P		P		P
R	P			P	
P	K				
B			K		

APR 2. Jerry Grossman needs help training his robots. Ten workers in a certain high-tech office have purchased a fleet of voice-activated robots to help them with various tasks, such as getting coffee, delivering mail, and carrying

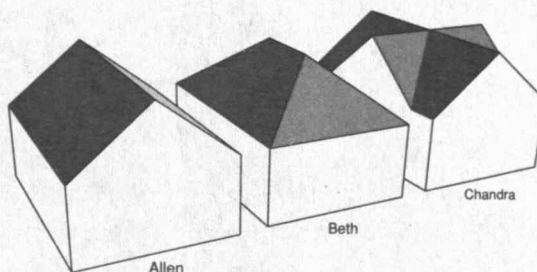
furniture. The robots are expensive, so they bought only seven of them, assuming that no more than seven workers would be needing robots simultaneously. Each robot can serve any number of masters (though only one at a time), but in order to respond to voice commands, a time-consuming and expensive training session is needed between each robot and each master it will serve. To avoid waste, the workers want to conduct as few training sessions as possible. Determine what training sessions should be conducted to achieve these aims.

APR 3. Liet Van Phan wants you to find angle DAC without using either Pythagoras's theorem or trigonometry. Measured in degrees, angles B and C are each 90 and angle D is 75 and CB is half as long as DC.



Speed Department

Geoff Landis notes that Allen, Beth, and Chandra built houses with identical planforms, but decided on different roof designs as shown below. The pitch of the roofs are identical. Which has the greatest roof surface area and which the least?



Solutions

N/D 1. We begin with a bridge problem from Winslow Hartford in which South is in an impos-

sible contract of 6NT. However, West leads the spade 4, which East wins with the ace and returns the spade queen. How can South now make his contract assuming best defense from this point onward?

North	
♠	5
♥	A K 8
♦	A 8 3
♣	A J 10 7 5 4
West	
♠	10 8 7 4 3
♥	7
♦	Q 10 9
♣	Q 8 3 2
East	
♠	A Q 9
♥	J 6 5 4 2
♦	J 6 5 2
♣	6
South	
♠	K J 6 2
♥	Q 10 9 3
♦	K 7 4
♣	K 9

The following solution is from Jonathan Hardis. William Tripp remarks that the problem is an example of a guard squeeze.

After the ace of spades is played and East leads the queen, it's easy to count 9 tricks:

- ♠-K, J
- ♥-A, K, Q
- ♦-A, K
- ♣-A, K

The problem is to develop three more. South covers the queen of spades with his king, and discards the diamond 8 (not a club, not the 3!) in dummy. South next leads the club 9 from his hand. If West plays low (best defense), South overtakes with the 10, which becomes the first extra trick. If West plays the queen, South overtakes with the ace and dummy's clubs provide all three extra tricks.

South next leads the heart 8 from the board. If East plays the jack, South overtakes with the queen and the 10 of hearts becomes the second extra trick. If East plays low, South plays the 3 and the 8 becomes the second extra trick. At this point, West's hand looks like this:

- ♠-10 x x
- ♥
- ♦-Q x x
- ♣-Q x x

South cashes the ace and king of hearts, returns to his hand with the king of clubs, and cashes the queen or 10 of hearts. West must find three discards for the hearts. (1) If he discards a club, the club jack becomes the third extra trick. (2) If he discards two spades, South's fourth spade becomes the third extra trick. (3) He discards at least two diamonds. (East protects the diamond jack.)

South plays accordingly: (1) On the fourth heart, discard the diamond 3, cross to dummy with the diamond ace, and cash the ace and jack of clubs,

Continued on Page MIT 45



SEND PROBLEMS, SOLUTIONS, AND COMMENTS TO ALLAN J. GOTTLIEB, '67, THE COURANT INSTITUTE, NEW YORK UNIVERSITY, 251 MERCER ST., NEW YORK, N.Y. 10012, OR TO: GOTTLIEB@NYU.EDU

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Dr. Seamans left MIT to join RCA as chief engineer in airborne systems and missile electronics and controls. In 1960, he went to NASA, first as associate and then as deputy administrator, with all programs, including Apollo, the program that landed men on the moon, reporting to him. Returning to MIT briefly in the late sixties, he went back to Washington in 1969 as secretary of the Air Force and subsequently served as president of National Academy of Engineering and head of the Energy Resource and Development Administration, which later became the Department of Energy. In 1977, he again returned to MIT as the Henry Luce professor of environment and public policy and served as the dean of the School of Engineering from 1978-1981. Since retiring in 1984, he has been a senior lecturer in aeronautics. Dr. and Mrs. Seamans were married in 1942; they have five children and eleven grandchildren.

GIFT OF CAPITAL: The Robert C. Seamans, Jr., Life Estate Fund and the Apollo Program Fund to establish the Apollo Professorship.

QUOTE: With all our moving back and forth, we ended up with two homes—one in Cambridge, which had appreciated almost ten times in value. We gave it to MIT, retaining the right to live in it. When MIT sells it, the proceeds will be added to the Apollo Program Fund, which we set up to establish the Apollo Professorship in Astronautics.

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Photo: Richard Howard



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Green Entrepreneurs

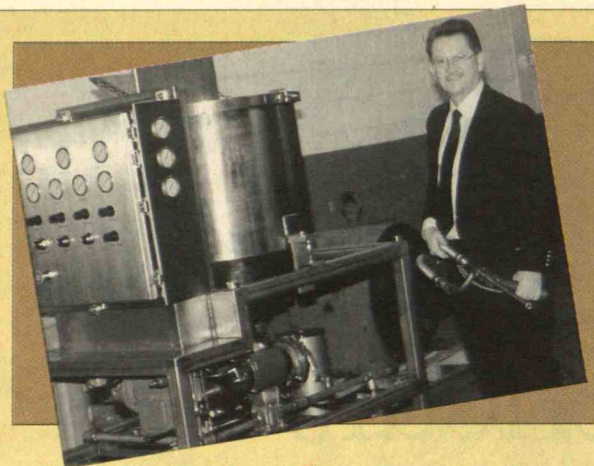
TWO technicians flip down the visors on the silver helmets of their “space suits” and step into the bay of a two-story metal-stamping press at Dickey Grabler, a machine-manufacturing company in Cleveland. The press has been shut down and covered by a huge plastic bag. Oil and dye-release agents cling to every piece—the big support beams, the huge clutch, the highly polished chrome hydraulic cylinder. The chemicals must be removed.

One technician grabs the nozzle of a three-quarter-inch stainless steel hose, braces himself, and opens the valve with a heavily gloved hand as if fighting a raging fire. But it is not water that gushes out. Rather, a curious granular substance, like hard white rice, blasts and splatters the press.

The “rice” is actually pellets of dry ice, stored in a large refrigerated box and pumped through the nozzle at up to 400 pounds per square inch—three times the force of sandblasters—by a custom-designed machine controlled by a second technician. In a few hours the toxic chemicals are stripped from the press and the dry ice pellets have fallen to a drop cloth on the ground and evaporated, leaving only a small amount of residual grime for disposal.

For years, Dickey Grabler hired workers to blast its presses with ground corn cobs or to wipe them

*Tough new
environmental
regulations have
created a growing
niche for
enterprising
scientists and
engineers.*



JAMES BECKER

Cryogenics Engineer

COMPANY

Waste Minimization and Containment Services

SALES

\$2 million

PRODUCT

Systems to clean industrial facilities and machinery

PROBLEM

Cleansing of industrial surfaces leads to large volumes of toxic or hazardous waste because the cleanser binds with the contaminants

SOLUTION

Blast dirty surfaces with guns that deliver dry ice pellets; contaminants fall free but cleanser evaporates, reducing waste volume

with chemicals, but because the cleansers combined with the contaminants, the firm was left with a large volume of toxic waste. Regulations made disposal at the nearest toxic waste site difficult and cumbersome, and the mounting cost of disposal—more than \$500 a barrel—strained Dickey Grabler's budget. With the new dry-ice process, the repository is less burdened, Dickey Grabler saves money, and the purveyor of the cleaning technique—Waste Minimization and Containment Services—has emerged as a hot new concern.

Welcome to the environmental business, a commercial sector that does much more than recycle newspapers and add "biodegradable" labels to detergent boxes. Entrepreneurs like James Becker and Jay Armstrong, two cryogenics engineers who founded Waste Minimization in Cleveland last year, are commercializing technical solutions to many specialized industrial problems—from improving the fuel efficiency of ferries to turning packaging waste into signposts. Although

many large corporations now boast about their environmentally friendly products, small start-up companies run by scientists and engineers like Becker and Armstrong are inventing and marketing many of the processes that actually cut waste and cleanse pollution.

Regulations Spur Growth

Market analysts generally divide the environmental industry into five sectors: recycling or disposal of solid waste, remediation of polluted areas, air pollution control, water treatment, and engineering and consulting services. Each sector has been growing at a healthy clip. According to G. Mead Wyman, a partner at the Boston venture capital firm Hambrecht & Quist Venture Partners, "Some sectors are expanding at 35 percent a year. Even the 'slow' sectors are still growing at 10 to 20 percent annually." The stock market research firm Alex, Brown & Sons in Baltimore reports that, overall, the environmental industry topped \$75 billion in 1990, increasing by more than 20 percent yearly since 1985.

Why the rapid growth? There is little question that the public's interest in buying environmentally sound products has played a role. But Joseph Jacobs, who more than 30 years ago founded Jacobs Engineering Group in Pasadena, Calif.—now a \$1 billion company that derives one-quarter of its business from environmental work—stresses a different factor. As he explains, "The industry is not driven by economics, or a need to meet a market that wants new products. It's driven by compliance with regulations."

The new Clean Air Act is expected to create a massive new market, for example. Analysts at Alex, Brown estimate that U.S. industry, especially petroleum refiners, vehicle makers, power utilities, and manufacturers, will spend \$20 billion by the year 2000 on improved air-pollution-control systems. The firm predicts demand for wastewater treatment technologies to grow by more than \$100 million annually as municipalities start to aggressively enforce new regulations established by the recent Clean Water Act reauthorization and the Safe Drinking Water Act. And a flurry of new municipal solid-waste initiatives will expand markets by closing landfills and driving up fees charged for waste disposal.

Regulations like these mean opportunities for entrepreneurs. While huge companies like Jacobs Engineering and Waste Management command a large share of the environmental business, making most of their money on trash collection, landfills, and big construction projects, small innovative companies are able to react quickly to the new regulations and cater to the specialized needs of local customers.

When Becker and Armstrong saw their opportunity to improve on cleaning processes that result in large volumes of contaminated waste, they began by experimenting with materials such as liquid carbon dioxide in a pressurized tank. They designed a nozzle that turned

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the liquid into snow as it streamed from the tank and forced the snow through an extruder to create frozen pellets the size of rice. They then designed a machine to propel the pellets with air or nitrogen through a hose, and "guns" to shoot pellet streams at different pressures, depending on the surface to be cleaned.

■ Their equipment is more costly than that used in water, sand, or corn-cob blasting—a full-scale industrial system can cost \$150,000 or more—and the cleaning process is more time consuming. But it affords a reduction in waste of up to 99 percent, far superior to other techniques. With tightening rules on hazardous waste disposal, the dry-ice method may be a company's only viable choice. In nuclear plants, for example, sandblasting just one ounce of radioactive material from one square foot of a contaminated cement floor can produce as much as 10 pounds of hazardous waste. A Department of Energy study reveals that sandblasting surfaces inside nuclear plants during routine cleaning results in 220 barrels of radioactive waste, versus just one barrel using the dry-ice technique.

Waste Minimization is working with the U.S. Air Force on systems to knock lead paint off aircraft, and with firms like Ford and AT&T on more delicate equipment to shear the tiny lines of metal flux off printed-circuit boards.

Driving Costs Down

Of course, the rapid growth of the environmental industry does not guarantee success even for an individual with a clever innovation. Failure to rigorously study the economics of their products or processes is a major pitfall for technical entrepreneurs, says John Ehrenfeld, director of MIT's Technology, Business, and the Environment Program. "It's so easy for a guy with a new company to say to himself, 'I've got a new soap, and everyone agrees it's environmentally wonderful. And it only costs 15 percent more.' Then when no one buys it, he can't understand why." Even if the public talks about spending more to buy green products, Ehrenfeld says, individuals are often reluctant to take action at the supermarket.

Roger Wittenberg has learned that lesson well. He runs two companies: the first recycles one type of waste, and the second recycles waste from the first. Wittenberg, a chemist, started Coastal Milling in Philadelphia in 1987; today the company produces 10 million pounds of animal feed a month from packaged foods discarded by manufacturers because of minor defects. As the firm grew, Wittenberg faced a mounting problem: he was paying between \$30,000 and \$40,000 a month to discard the plastic and paper packaging that contained the damaged food.

So he started a second company, Rivenite Corp., to turn the packaging into building materials. He grinds and melts the plastic and paper, then mixes the material

with sawdust and uses custom machines to extrude it into standard lumber shapes. The end product is a substance (also called Rivenite) that Wittenberg says looks like wood but holds paint and fasteners such as nails better than wood and won't rot or swell with moisture. Wittenberg sells the wood/plastic composite to makers of everything from outdoor furniture and heavy industrial flooring to marine decking and roadside signposts.

Though it costs 10 to 15 percent more than other materials up front, customers who calculate long-term costs find Rivenite worth the extra expense. For example, he guarantees that his municipal signposts will last 35 years; regular wood posts must be replaced every 7 or 8 years. The labor costs alone for this replacement are far higher than the premium paid for Rivenite.

Even so, driving down his prices is a large part of Wittenberg's effort. "Homeowners who walk into a store to buy a new post for their mailbox are only going to buy our post if it's better than a wooden one and doesn't cost much more. They're not going to buy it because it's made from waste," he says.

The lesson is more than anecdotal. Studies by Green Seal, a nonprofit organization in Palo Alto that approves consumer products meeting strict environ-



WILLARD MONSELL

Educator

COMPANY

Advanced Power Systems

SALES

\$180,000

PRODUCT

Petroleum fuel additive

PROBLEM

Cutting air pollution from vehicles with poor fuel efficiency and high emissions

SOLUTION

Insert a catalyst in the fuel line that improves combustion, raising efficiency and lowering exhaust emissions

mental standards, show that four of five consumers would buy a product with the Green Seal label when choosing among goods of equal price and quality. "But they are not going to pay much more," says Green Seal president Denis Hayes. "At 5 percent more you might still get a lot of buyers, but at 10 percent more they really start to tail off."

This reality can make life difficult for environmental entrepreneurs, as David Spencer, head of the wTe Corp. in Bedford, Mass., can attest. With a PhD from MIT in metallurgy and 10 years of experience at Raytheon, Spencer started his company in 1981, deriving its name from the concept of "waste to energy." The firm, which recycles metal, plastic, and other solid waste collected by municipalities, has grown quickly to more than \$30 million and 200 employees. But Spencer says profitability is still slow in coming.

Like Wittenberg, Spencer wants to price his recycled material competitively, but environmentally sound processes frequently cost more and are technically sensitive. Spencer's wTe recycles 15 million bottles a month, but the melting and reforming process is tricky. If even a small amount of one of the two main plastic chemi-

cals—polyethylene terephthalate (PET) and polyvinyl chloride (PVC)—gets into a molten batch of the other, it will contaminate the entire run.

This kind of sensitive system also makes ensuring the uniform appearance of the final product a challenge. Variants in the processing can turn the re-formed bottles opaque, and bottlers won't stand for the variation. "No one wants to buy Pine-Sol in a mottled bottle," Spencer says. "The product has to look, feel, and behave the same way every time." To combat such problems, Spencer has invested in custom sensors and machines such as electrostatic separators to replace conventional separation methods. Such advanced process technology, he says, helps him remain competitive.

Consultants, Not CEOs

Given the unsure actions of buyers and the tight rein on credit, many scientists and engineers who have bright ideas choose consulting rather than marketing their own products. There is a growing demand for people who have expertise in process technology, for example. "Many companies can cut down on waste or pollution," MIT's Ehrenfeld says, "but they seem to wait for someone from the outside to bring them some new magic."

One such magician is Tom Belmont, a chemical engineer who left the security of his corporate job in 1981 to start Wastewater Systems Engineering (now called L & T Technologies), an environmental engineering company in Bridgewater, Mass. Belmont foresaw the trouble many large companies would have in meeting stricter wastewater regulations and decided to market his experience in reclaiming toxic metals from industrial processes.

The federal Clean Water Act required that metals be removed from wastewater beginning in the early 1980s, and soon thereafter disposal fees also rose, convincing companies to capture the metals for reuse. Belmont rode this wave of regulation with the rest of the water treatment industry, first designing wastewater treatment systems, then consulting with firms on how they could best recover metals from waste streams. Sales have increased to more than \$3 million, and Belmont says he anticipates further growth despite the current recession.

As Belmont points out, wise use of consultants can do much more for a company than reduce waste. A classic example is the Robbins Co. in Attleboro, Mass., which first sought outside expertise in 1985 because it was on the brink of shutting down. The company had been heavily fined for polluting the local Speedway Brook and Ten Mile River. Dumping charges for toxic residues were also skyrocketing, and insurance against hazardous waste leaks had risen to \$150,000 a year.

Robbins, a \$30 million electroplating company, used processes that required large amounts of water and left behind a host of toxic residuals such as acids and heavy



DAVID SPENCER

Metallurgist

COMPANY

wTe Corp.

SALES

\$40 million (1990)

PRODUCT

Recycled plastic, metal, solid waste

PROBLEM

Finding economical processes that convert separated plastic into useful raw materials

SOLUTION

Clean the trash, and pulverize or beat it, to produce pellets or flakes that can be made into new bottles or containers

metals. Robbins' waste treatment engineer brought in Belmont, who suggested a complete overhaul, integrating treatment with a closed-loop system that would eliminate wastewater altogether. Although the system would cost more than \$220,000, almost half the company's annual budget for capital expenditures, Robbins decided it was necessary for survival.

The system, finished in 1988, uses 82 percent fewer chemicals, generates 89 percent less toxic sludge, and reduces lab costs by 87 percent. What's more, the system has made the electroplating process so efficient that the company is saving more than \$70,000 a year in chemicals, water charges, and disposal fees; the new equipment will have paid for itself in less than four years. Perhaps the biggest surprise is that Robbins, once hated by the community as an egregious polluter, has improved its public image and says that local orders are increasing.

Rewarding Risk-Takers

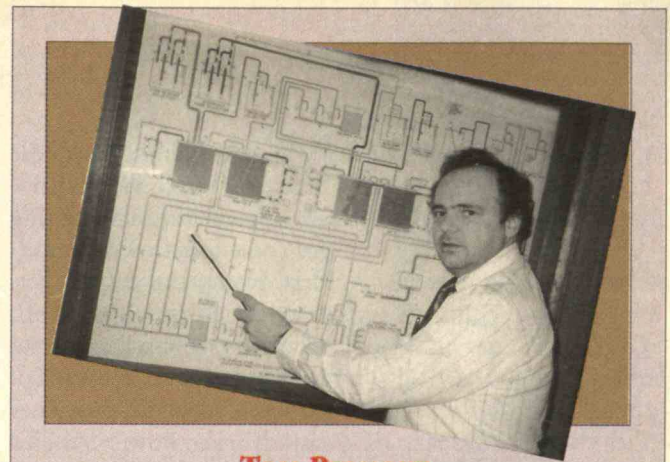
Because environmental businesses are often risky start-ups, virtually all green entrepreneurs, including those already mentioned, have struggled for funding at some point. Some state and federal initiatives—such as “centers of excellence” or other incubators of technological innovations—offer financial and planning assistance to nurture these entrepreneurs.

Many new environmental processes are actually aimed at municipalities, which are largely responsible for reducing waste, recycling, and reclaiming polluted environs. But the poor economic health of municipalities may make them unwilling to take risks with new processes.

Despite the economic climate, there are many measures local governments can take, says Ron Reilly, CEO of Environmental BanCorp in Southport, Conn., a firm that matches entrepreneurs with investors and provides financial services to environmental start-ups. One possibility is to establish a loan fund for small companies with solutions to municipal problems. Connecticut was the first state to try this idea when it announced a \$10 million loan pool for environmental concerns last year. “Only a few states have followed,” Reilly says. “We need more.”

States could also expand their innovative technology programs that help entrepreneurs start pilot plants. Even more importantly, says Reilly, is help in “moving pilot plants up to commercial scale.” To raise seed money for such programs, municipalities could draft performance bonds for municipal projects, Reilly suggests. Once sold to investors, these spread the financial risk should a new process fail.

Other financial planners conclude that the risk-taking will have to come from the private sector. One such innovator is James Lunny, head of Leading Edge Environmental Products in Northampton, Mass., which dis-



TOM BELMONT

Chemical Engineer

COMPANY

L & T Technologies

SALES

\$3 million

PRODUCT

Engineering consultation

PROBLEM

Tougher regulations and higher disposal fees force companies to change systems that treat and recapture process wastes

SOLUTION

Redesign processes

tributes environmentally friendly products and helps match investors with entrepreneurs and municipalities.

Lunny has put together several deals in which an investor buys relatively untried equipment from an entrepreneur and gives it to a risk-averse municipality. The municipality agrees to pay the investor whatever it saves by using the new equipment. If, for example, new machines for processing solid waste reduce the municipality's expenses by 7 percent, it pays the investor the equivalent sum. After several years, when the agreement ends, all three parties should emerge winners: the entrepreneur has made money by selling machines to the investor; the investor has been paid by the municipality; and the municipality has received free equipment that will eventually mean savings. Several investment firms—such as Co-Energy of Santa Monica—are now establishing such agreements, Lunny says.

While many innovators can manage to start a business by remortgaging the house or asking a few friends to chip in as partners, gearing up a prototype process to the commercial level can cost millions of dollars, and local banks are wary of lending to start-ups. “We actually get more requests for ‘mezzanine’ financing than for start-up money,” Reilly says. The inability to secure this

Proving One's Metal

THE public's strong desire to protect the environment can pave the way for some questionable products. No one knows this better than Willard Monsell, who is trying to sell a product in a market he admits is full of phonies. Monsell, co-owner of Advanced Power Systems in Kent, Conn., is the sole North American distributor of the Broquet Fuel Catalyst, made in England. The catalyst is a tin-alloy fixture that is placed inside the fuel tank or fuel line of a vehicle burning gasoline or diesel; its presence improves combustion, leading to greater fuel efficiency and lower emissions.

Monsell claims that his product has been proven effective in tests by municipalities, private concerns, even the Air Force—which found that hydrocarbon emissions in trucks and buses were reduced 33 percent, and carbon monoxide was cut almost to zero. But the Broquet system must compete with more than 100 other fuel economy products, some with names like Vitalizer, Petromizer, and Platinum Gas Saver. Most are sold through local newspaper ads, and Monsell says many are frauds. The operators who haven't been shut down are being pursued by state attorneys general, and their existence has made it extremely hard for Monsell to get prospective clients to try the Broquet system. "Our product is in a category that is suspect," he says, "and rightfully so."

The Broquet system consists of a cannister with a central rod on which hang 10 to 45 small tin-alloy cones. As the fuel flows over the cones,

tin compounds enter the fuel and are converted to an oxide form, which absorbs trace elements of metal ions in the fuel under the high temperature and pressure of the combustion chamber. Removing these ions results in a cleaner, more efficient burn. Monsell says use of the system improves fuel economy by an average of more than 7 percent. One cannister typically lasts 250,000 miles.

The system costs too much to yield any savings in cars but seems to make sense for larger vehicles like trucks and buses. A typical 300-horsepower tractor-trailer truck gets 6 miles to the gallon on diesel fuel. At \$1.25 a gallon, that adds up to more than \$52,000 in fuel over 250,000 miles, not uncommon mileage for a commercial truck. A 7 percent improvement in efficiency would save more than \$3,600. Monsell says the system for a tractor trailer costs only \$530.

Monsell has just begun a major test with Marine Atlantic, a ferry operator in New Brunswick. Marine Atlantic's ferries have four 7,000-horsepower engines, and the plan is to put the Broquet system in two of them for comparison. The system and installation will command a hefty price—\$39,500 per ferry—but the savings could be substantial. Marine Atlantic pays 95 cents a liter for fuel, and runs its ferries almost continuously. A 7 percent improvement in efficiency, Monsell says, could save \$345,000 over 5,000 hours of operation in only nine and a half months.

—Mark Fischetti



second round of financing is what most often kills young businesses, he says.

Reilly says investors are out there, however, not so much because they would like to help the environment but "because there is a real potential to make money. The environmental business is one of the few growth industries."

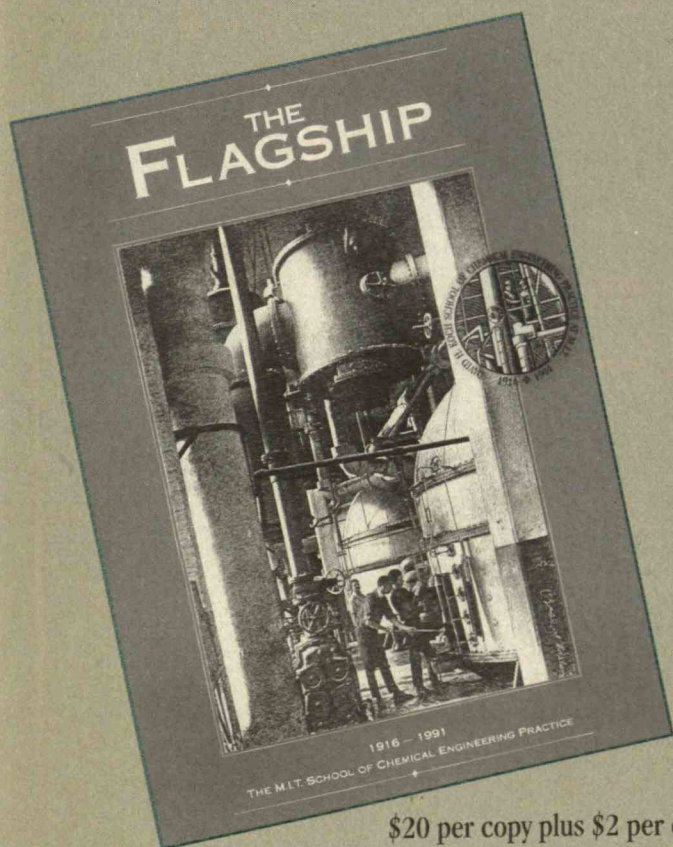
While venture capitalists are showing some interest, more large firms are looking to license a new technology or buy equity in a promising company. "The venture people want to ride the environmental wave," Reilly says, "but most want to make larger investments." Reilly also says that venture capitalists tend to invest in industries that are more cohesive. "Most environmental businesses tend to be specialized and are targeted at local markets." As a result, he says, "most of the deals we've put together are for, say, a \$5 million company to license a new technology from an entrepreneur or for a \$50 million company to buy into a \$5 million company."

Fortunately for would-be entrepreneurs, there is a new and growing source of capital. Half a dozen investment funds established in the last few years cater to

environmental businesses. Among them are Hambrecht & Quist's Environmental Technology Fund in Boston, and 1st Analysis Corp.'s Environmental Venture Fund based in Chicago.

Reilly's Environmental BanCorp is in the final stages of putting together an even more ambitious effort: the 1st Environmental Bank & Trust Co., the nation's first full-service bank dedicated exclusively to environmental businesses. The trust, which Reilly says will amass from \$50 million to \$100 million in assets during its first three years, is funded by wealthy individuals who want to help new companies clean up the environment. Once opened in the second quarter of 1992, 1st Environmental Bank & Trust will provide loans to small and medium-sized companies and will offer the financial services now provided by BanCorp.

The availability of funding from places like the Environmental Bank & Trust will no doubt help many scientists and engineers become successful environmental entrepreneurs. But the most important factor is sheer opportunity. "There's a lot of money to be made," says Roger Wilson, head of MIT's Venture Capital Network. "And this is a field in which technologists thrive." ■



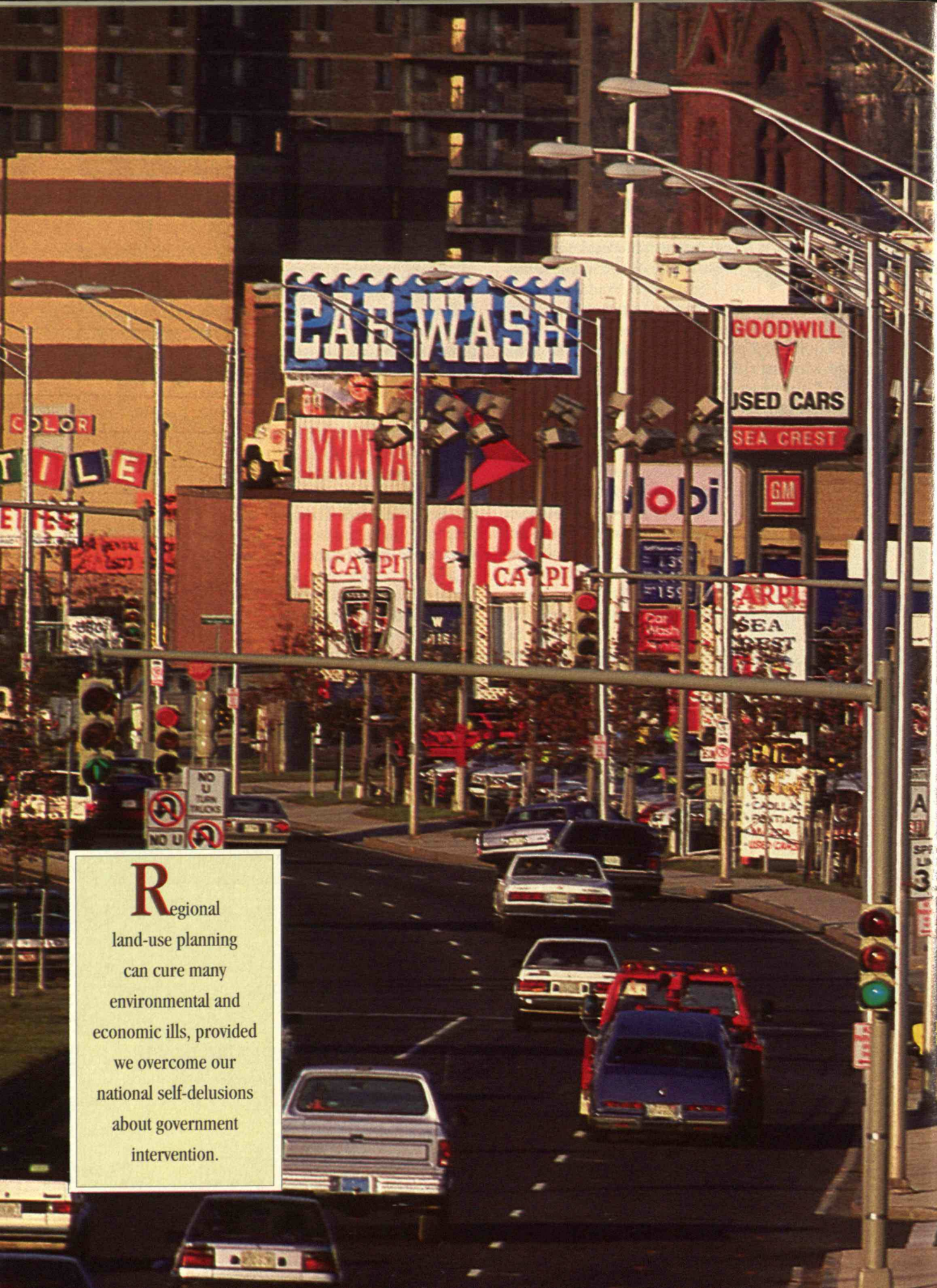
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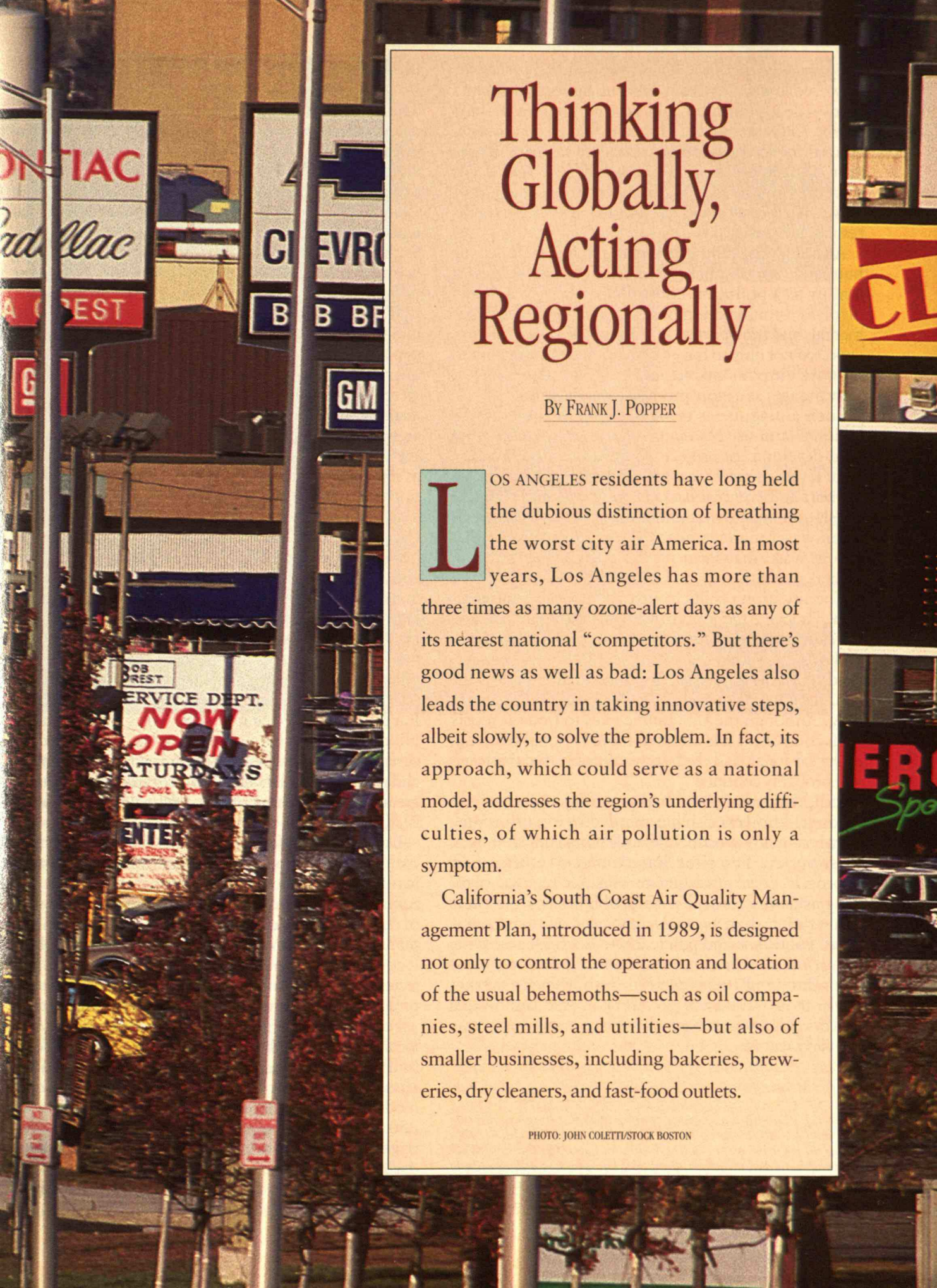
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Regional
land-use planning
can cure many
environmental and
economic ills, provided
we overcome our
national self-delusions
about government
intervention.



Thinking Globally, Acting Regionally

By FRANK J. POPPER

LOS ANGELES residents have long held the dubious distinction of breathing the worst city air America. In most years, Los Angeles has more than three times as many ozone-alert days as any of its nearest national “competitors.” But there’s good news as well as bad: Los Angeles also leads the country in taking innovative steps, albeit slowly, to solve the problem. In fact, its approach, which could serve as a national model, addresses the region’s underlying difficulties, of which air pollution is only a symptom.

California’s South Coast Air Quality Management Plan, introduced in 1989, is designed not only to control the operation and location of the usual behemoths—such as oil companies, steel mills, and utilities—but also of smaller businesses, including bakeries, breweries, dry cleaners, and fast-food outlets.

PHOTO: JOHN COLETTI/STOCK BOSTON

Eventually, it could ban such products as gasoline-powered lawn mowers, barbecue lighter fluids, and aerosol deodorants. It could raise parking fees if only one person is in the car and require that all automobiles convert to electric power or other "clean fuels" by the year 2007. In one of its most controversial aspects, the plan provides for controls to bring housing and jobs closer together to reduce commuting distances and the resulting air pollution.

Although the plan is marching forward under the banner of single-purpose legislation—most view it mainly as a pollution-control initiative—it actually involves a combination of regional land-use, environmental, and transportation planning. If successful, it is expected not only to remedy environmental woes but to improve the economic setting, by leading developers to view the area as a more promising investment.

Such a disguise is typical. Most of the nation's regional land-use planning—that is, the regulation of land-development projects by governments above the local level—is rarely recognized for what it is. To gain support and eventual passage, most regional planning legislation must travel under the cover of clean air or clean water management, wetland protection, hazardous waste management, and other, mostly environmental, pursuits.

The situation results from a widespread contradiction. Though Americans truly loathe the regulation and bureaucracy of big government—especially from federal or state, rather than local, levels—they also want, need, and benefit from big government. In no field is the contradiction as massive as in regional land-use planning. Although the U.S. public likes to think it resists such controls, it has adopted more regional planning each year for at least the last two decades, and this trend will probably continue.

Still, while many regional planning initiatives slip through—however single-minded in intention they may be—many worthwhile endeavors stall from lack of support. The time has come to rethink this approach. Local governments must see regional planning as a way to deal with problems beyond their reach rather than as an infringement on their operations. Politicians and political activists from across the spectrum must learn to look upon it as a means of smoothing out the imperfections of the free market rather than as a way of perverting it. And landowners and developers must begin to see it as a way to increase property values.

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Progress Despite Denial

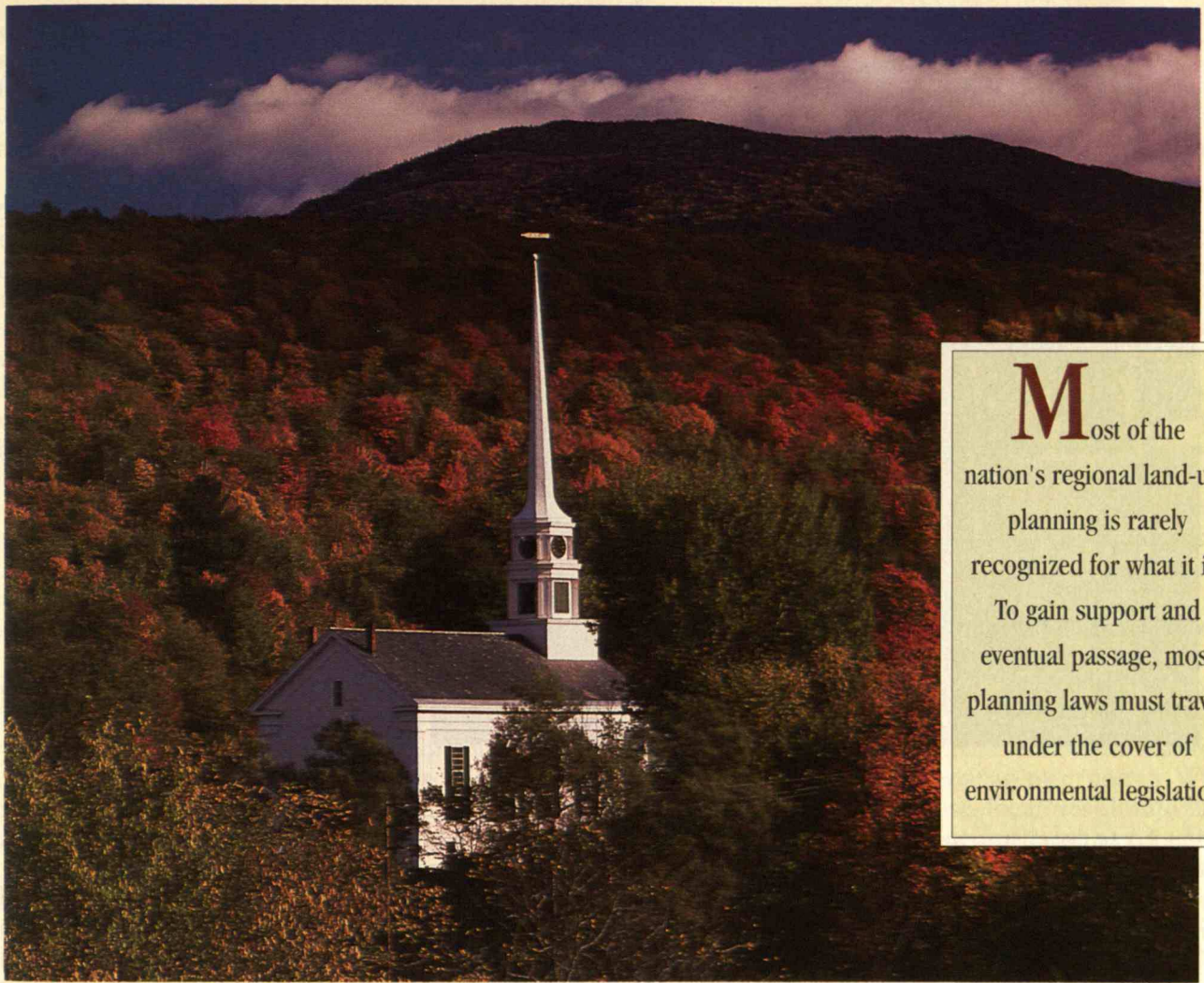
The national self-delusion about regional planning dates back to the very beginnings of U.S. land-use regulation. In fact, the first planning legislation at the national level, the Standard State Zoning Enabling Act issued in 1924 as a model law by the U.S. Department of Commerce, was rapidly adopted by the many states that wanted to delegate zoning authority to their localities. Such a localist bias persists to this day, as local zoning boards account for about 90 percent of all U.S. land-use decisions.

While local zoning gained momentum during the middle decades of this century, the antigovernment and prolocal predilections of most Americans doomed nearly all attempts at regional planning. Efforts that were enacted were usually short-lived or ineffectual. For instance, the visions of Lewis Mumford and his associates at the Regional Planning Association of America in the 1920s and 1930s—to plan entire metropolitan areas as units and to regulate so as to discourage land speculation—went largely unfulfilled.

One mid-century struggle involved the National Land Use Policy Act. This legislation—introduced every year between 1968 and 1975 by the late Senator Henry Jackson of Washington—would have provided federal grants so that states could draw up statewide or regional land-use plans, as well as devise procedures for protecting environmentally sensitive areas and regulating big private developments and public works projects. The bill achieved its greatest momentum in the summer of 1974, when the Senate passed it by its widest margin. But the House rejected it by seven votes when President Nixon withdrew his support in a last-minute bid for conservative votes to prevent impeachment. Planners and environmentalists have since regarded the bill as the great might-have-been of U.S. regional planning, a legislative lost chord never to be replayed.

Despite these defeats, by the late 1960s the advent of contemporary environmentalism was beginning to invigorate some portions of regional planning. Local zoning, a reform suited to an earlier era's rate and scale of development, could not deal with big energy facilities that might have statewide or even national implications. It could not cope with large, complex public works projects. And it could not handle the huge new residential projects that might impinge on neighboring localities.

For example, Vermont—whose town-meeting style of local planning had been unable to cope with carelessly built ski resorts and second-home developments—passed legislation in 1970 that became a bellwether for modern regional planning. Vermont's land-use law, Act 250, requires that large commercial, residential, industrial, and public-works projects meet stringent standards set by regional boards for such matters as soil erosion, sewage disposal, aesthetics, and wildlife preservation. And state residents agree that the nature of



Most of the nation's regional land-use planning is rarely recognized for what it is. To gain support and eventual passage, most planning laws must travel under the cover of environmental legislation.

growth has improved dramatically since the legislation's passage: investors credit the act for ensuring high-quality development projects and the consequent rise in property values.

By the early 1970s, as environmental pressures continued to grow, the states and the federal government increasingly intervened to create regional land-use mechanisms to regulate development of coastal, mountain, wetland, and farmland areas. As of 1975, some 37 states had created new programs for statewide planning or review of local regulatory decisions.

Federal funding for state-level programs also gained momentum. A steady stream of legislation—including the 1970 Clean Air Act, the 1972 Clean Water Act, the 1972 Coastal Zone Management Act, the 1973 Flood Disaster Protection Act, the 1974 Safe Drinking Water Act, and the 1977 Surface Mine Control and Reclamation Act—marked the beginning of the trend.

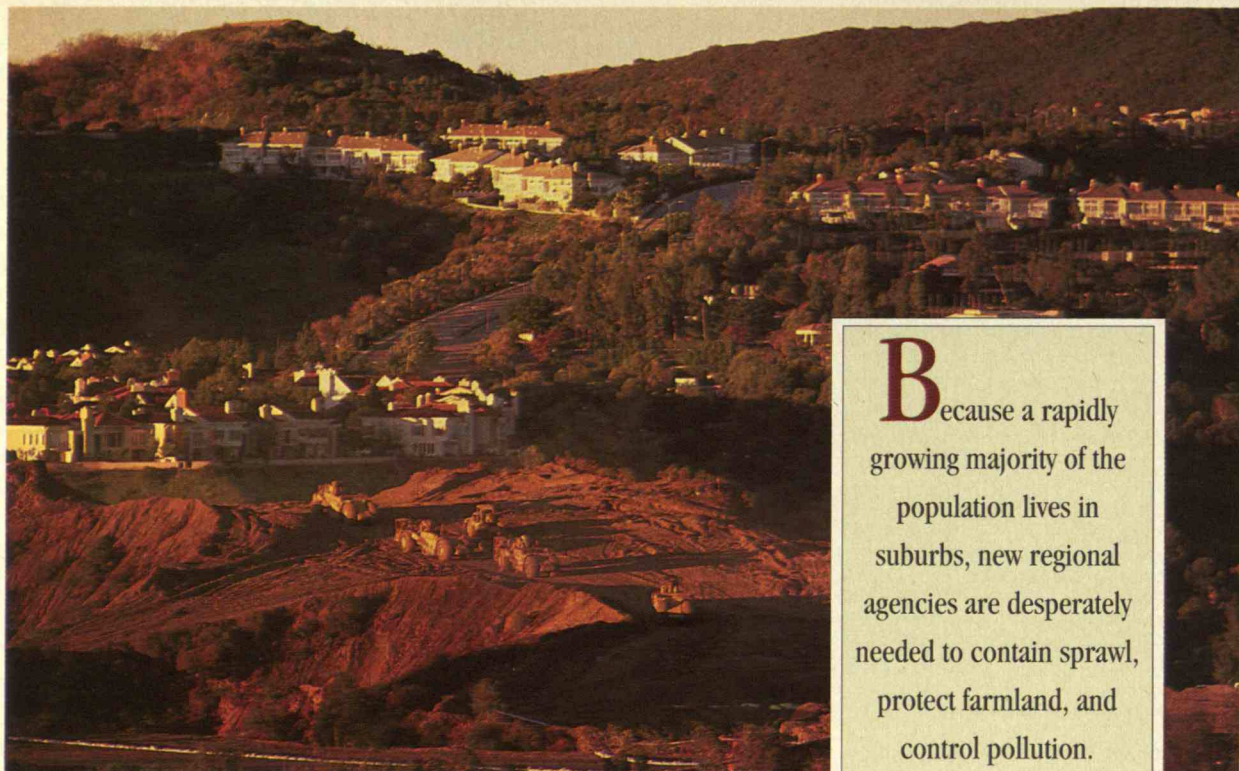
All these state and federal programs still exist, some in strengthened form. Their survival suggests that the mid-1970s failure of the National Land Use Policy Act, much lamented by planners and environmentalists, was essentially immaterial.

Governmental Forays

Many people assume that the 1980s brought catastrophic losses for environmentalism and land-use planning. But both actually enjoyed a remarkable net gain. Though the Reagan-Bush-era federal government largely decoupled itself from environmentally motivated planning in some important areas, it did enact several major land-use laws. And whatever ground the federal government did forfeit was more than made up by many states that were committed to the cause. In fact, *Governing* magazine concluded in 1989 that “land use is perhaps the the only area of governmental concern where regulatory power is currently moving upward.”

The Reagan administration did abolish a number of federally funded regional development agencies, including the Upper Great Lakes Commission and the New England River Basins Commission. It also cut funding for the Coastal Zone Management and Surface Mine Control Acts.

But it actively promoted the 1982 Coastal Barrier Resources Act to restrain some coastal growth, and in 1987 it expanded the Surface Mine Control and Recla-



Because a rapidly growing majority of the population lives in suburbs, new regional agencies are desperately needed to contain sprawl, protect farmland, and control pollution.

mation Act to cover strip mines of less than two acres, a major loophole for coal operators. It also incorporated more than 7,000 square miles of river banks into the federally protected wild and scenic river system.

The present administration's record on regional planning has been more puzzling. Although the Environmental Protection Agency announced a "no net loss" policy for the nation's wetlands early in President Bush's term, the administration in the summer of 1991 proposed reducing the national stock of wetlands protected under an Army Corps of Engineers regulation by tens of millions of acres. The action would certainly have entailed, as the Environmental Defense Fund said, "the largest weakening of an environmental regulation in U.S. history." Then, in the fall of 1991, the administration backed away from the reduction.

The administration has also set a 10-year moratorium on oil drilling off the coasts of New England, California, and Florida, authorized the Departments of Defense and Energy to spend nearly \$7 billion to clean up hazardous and radioactive waste, and strengthened the Clean Air, Coastal Zone Management, and Coastal Barrier Resources Acts.

The states have taken even more initiative, although their efforts tend to be aimed not at comprehensive planning but at particular land uses or landforms. A number of states traditionally committed to environmentalism—including Oregon, California, Florida, Vermont, New Jersey, and Massachusetts—introduced new programs to protect farmland, groundwater, and wet-

lands, to regulate floodplains, and to select sites for industrial, energy, and hazardous-waste facilities.

Several of these states upgraded existing programs. In the mid-1980s, Florida mandated that localities submit all zoning ordinances for state certification. And in 1987, Vermont extended Act 250 to developments with fewer than ten lots, a loophole that had resulted in an unusual number of nine-lot projects.

Perhaps the most intriguing trend in the 1980s was the entry of additional states onto the regional planning scene. Delaware, Rhode Island, and Washington passed their first statewide planning laws. More startling was the fact that several growth-oriented, regulation-averse Sun Belt states—Georgia, South Carolina, Texas, and Arizona—began exploring the possibility of regional planning. Joe Frank Harris, Georgia's governor, declared himself "the state's chief planner" and called for a Florida-like program, in which all of Georgia's local governments would draw up land-use plans for review by new regional agencies.

By the late 1980s, the state that led the nation in enacting single-purpose regional planning laws was New Jersey. Its hazardous waste, coastal zone, wetland, and farmland protection laws are among the strongest in the country. Southern New Jersey has regional regulation in the Pinelands near Philadelphia and Atlantic City, a surprisingly rural area comprising a fifth of the state. Northern New Jersey has regional regulation in the 30-square-mile Hackensack Meadowlands, one of the most rapidly developing areas in the entire New

York City metropolitan area. And the state's Mount Laurel legislation, governing the amount and placement of new low-income housing, has in some years stimulated the building of almost as much of this kind of housing as in all of the rest of the states combined.

New Jersey is now making its most ambitious foray into regional planning yet. The State Planning Commission is seeking to restrain the mid-1980s land-use diaspora that indiscriminately scattered development projects across the Garden State countryside. The most recent version of the plan, which appeared in July 1991, calls for concentrating new growth in or near existing villages, suburbs, and city neighborhoods. Counties and municipalities risk losing state funds for public works if their planning actions are inconsistent with these guidelines. In addition, state government will invest its funds and build its facilities in New Jersey's distressed big cities such as Camden, Newark, and Paterson. The state's efforts to focus regional land-use planning on the problems of large, poor, heavily minority cities is virtually unparalleled in contemporary environmentalism.

Building on Models

Despite these recent successes, much more needs to be done. We must rigorously address environmental and economic challenges, from containing suburban sprawl to reversing inner-city decay.

For two decades, more Americans have lived in suburbs than in cities or rural areas. And these suburbs, especially in the Southwest, are growing faster than any

other localities. According to the 1990 census, the nation's nine most rapidly growing areas over the last decade were five suburbs surrounding Los Angeles, two flanking Dallas-Fort Worth, one neighboring San Diego, and one abutting Phoenix. The slowest growing of the nine, Arlington, Tex., grew by 64 percent in the 1980s. All have populations of over 100,000.

These towns and their high-growth counterparts elsewhere—say, in Du Page County, Ill., west of Chicago or the southern New Hampshire suburbs of Boston—have weak and unconnected local zoning systems, heavy strip development and sprawl, disappearing farmland, and overburdened transportation systems. Each suburb, usually a mid-sized city in its own right, daily creates pollution, traffic, and a generally unaesthetic environment for its neighbors.

We have no models for suburb-specific regional planning. Yet by now many of our suburbs have the population, political heft, and land-use snarls that would justify creating them.

To deal directly with rapid suburban growth, adjacent suburban localities urgently need to either create functionally specific organizations—such as multi-suburb zoning boards, transportation authorities, or farmland-protection agencies—or combine several such functions into a multi-suburb growth-management agency. Whatever mechanism they choose, localities should band together to create bottom-up rather than top-down regional planning—or more precisely, to add bottom-up regional planning to whatever top-down regional planning already exists.

Unwelcome Exports

THE states that have become the leaders in regional land-use planning lie mostly in the Northeast, the Upper Midwest, and the Far West. The South (with the important exception of Florida, now the fourth-largest state), the Lower Midwest, and the Mountain West have tended to lag, for they—as numerous surveys have shown—have weaker environmental sentiments.

In some ways, this variation across states represents the responsible workings of American federalism: every

state's population gets the government it wants and deserves. But the variation also brings penalties that the planning-inactive states impose on the active ones, perhaps inadvertently but certainly unfairly.

Consider Texas and Louisiana, which are upwind and upstream, via the Gulf of Mexico, from Florida. In 1989, the Environmental Protection Agency ranked these two states first and second in releasing the most toxic chemicals into the air, water, and land. They were

home to four of the nation's ten most polluting manufacturing facilities, including the two worst sites, Monsanto's plant in Alvin, Tex., and American Cyanamid's in Westwego, La., both near the Gulf of Mexico. Large amounts of their releases inevitably drift to Florida, degrading its environment even as its state land-use law tries to improve it.

Similar situations recur across the country. Ohio and Indiana, the third and fifth leading polluters in the 1989 EPA rankings, export some of their air pollution to

Vermont. The upshot is that states in the upper tier of environmental activism suffer for their virtue while those in the lower tier benefit from their vice. The eventual solution seems likely to be federal ceilings on permissible amounts of interstate pollution, accompanied by mechanisms that require states that export their pollution to compensate the states receiving it. Interstate regional agencies could play a role in mediating and enforcing these actions. ■

—Frank J. Popper

A second pressing challenge is to find a way to locate sites for a backlog of regional or national projects that are objectionable to many people who would live near them. No large, free standing hazardous waste facility has been built in the United States since the late 1970s. Most big cities have not begun a major highway, mass-transit, or low-income housing project in more than a decade. Only two cities, Denver and Austin, have begun building major airports since the early 1960s. I refer to such projects as "locally unwanted land uses," or LULUs, which evoke a NIMBY, "not in my backyard," response.

Regional planning could help undo LULU blockage. For example, we could establish a point system that would allow open trading of proposed LULUs between cities in a region or counties in a state. A suburb that agreed to accept, say, a hazardous waste facility could decline the next three halfway houses. Or it could exchange a coal-fired power plant for six trailer parks or three middle-income housing developments.

A regional or state planning body would set minimum point scores for each city or county and then oversee and enforce the transactions. Localities would have the flexibility to work out among themselves the exact ways and precise trades by which they would meet the regional-equity goal. Such an approach would not only help complete such projects but would add fairness, openness, predictability, and a regional perspective to siting processes that consistently lack them.

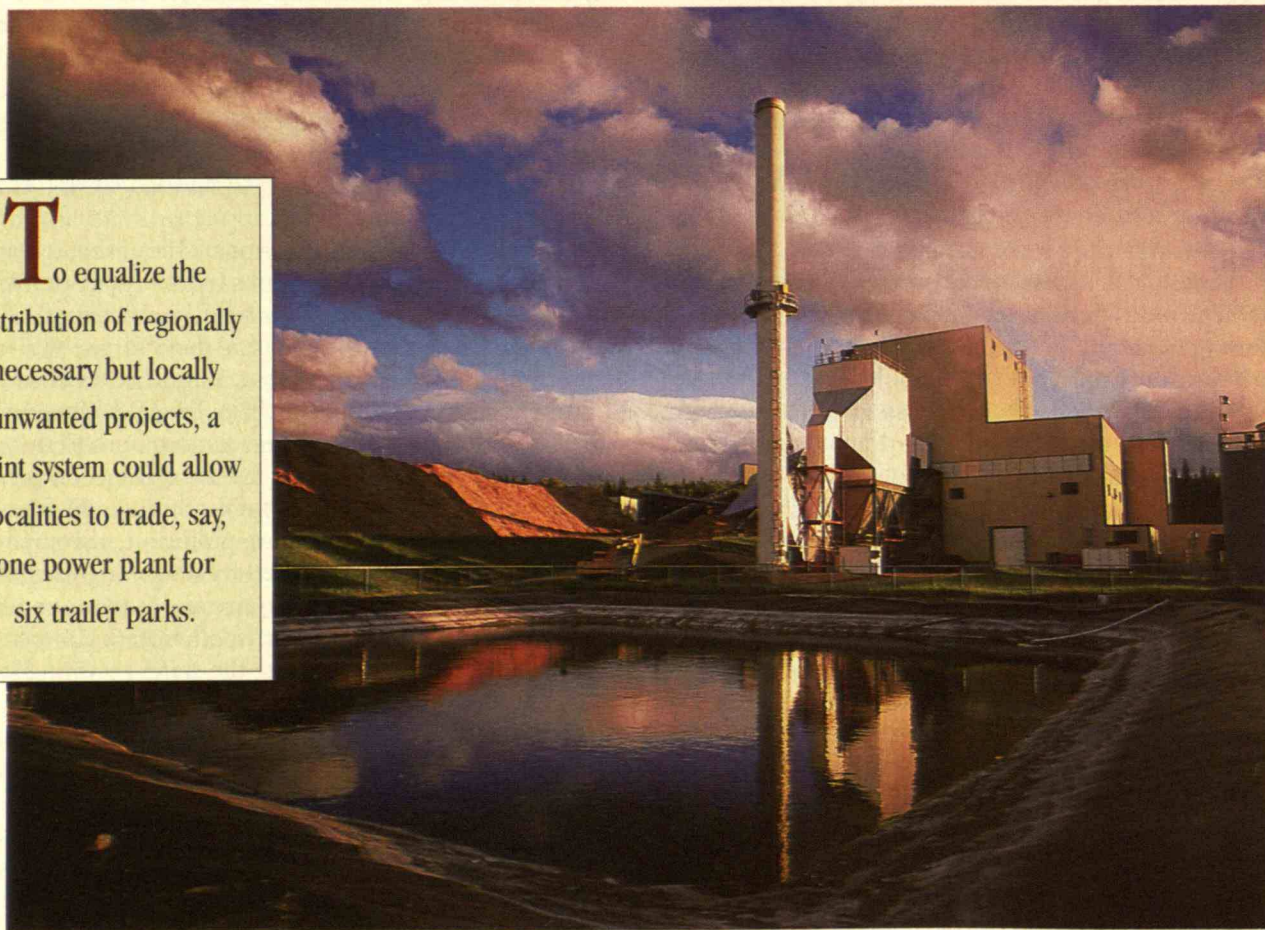
Regional planning might also be used to achieve dramatic results in the inner city. In fact, we may be misdirecting our regional planning by almost totally overlooking the large, decaying, often racially divided urban slums. It would be good to see environmentally oriented regional land-use planning find ways to do something useful for the nation's slums as well as for neighborhoods worried about becoming slums.

Such planning might, for instance, emulate New Jersey's distressed-cities provision and focus public investment and construction in depressed neighborhoods. Or it might reduce the number of LULUs in these areas. For example, New York City's planning commission, whose five-county jurisdiction itself amounts to a region, has begun an innovative attempt to equalize the distribution of city-built LULUs—such as homeless shelters, jails, and group homes—across neighborhoods. If the effort works, poor and working-class neighborhoods will get fewer LULUs and richer ones will get more of them.

Regional planning could also help combat the spread of rural poverty. For example, both the Tennessee Valley Authority, established in 1933, and the Appalachian Regional Commission, established in 1965, offer models of regional planning agencies that contributed to the economic development of disproportionately poor hinterland regions.

The Lower Mississippi Delta Development Commis-

To equalize the distribution of regionally necessary but locally unwanted projects, a point system could allow localities to trade, say, one power plant for six trailer parks.





New Jersey's plan to invest public funds and build government facilities in Newark, Camden, and other distressed cities could serve as a model for states hoping to reverse inner-city decay.

sion, whose reach extends to 214 counties in 7 states from Illinois to Louisiana, serves as an example of how reviving the TVA-ARC tradition can revitalize today's depressed rural areas. Established in 1988 to help a mostly black region with a declining number of farmers and some of the nation's worst poverty, the commission uses state and private financing to underwrite locally originated self-help initiatives, such as county economic development corporations. It tries to encourage the creation of food-processing jobs—for instance, flash-freezing and packaging—within the Mississippi Delta, rather than letting the region's agricultural products be processed elsewhere.

"We would like to identify five alternative crops that have this capacity for growing and processing here in the region, just as we now do with catfish," the Commission's executive director recently told *The New York Times*. Filleting, processing, and packaging Mississippi River catfish provides the Mississippi Delta with thousands of jobs.

A similar approach might focus on the Great Plains, a 435-county region that encompasses parts of 10 states from Montana to Texas, between the Rockies and the Corn and Cotton Belts. This area, which typically receives less than 20 inches of rain a year, confronts many problems: aging communities, fading farming and ranching, high soil erosion, aquifer drawdown, continued depen-

dence on federal subsidies, and a century-long rural depopulation that may now be accelerating. It desperately needs to invigorate and diversify its economy.

A Plains agency might concentrate its efforts on the region's economically lagging counties. With local and private support, the agency would encourage land uses that have potential for environmentally benign economic growth, including sustainable forms of agriculture and tourism, recreation, retirement, and wilderness activities.

For example, by promoting purchases by private land-preservation organizations like the Nature Conservancy or its state and local counterparts, a Plains agency might help struggling cattle ranchers convert to higher profit, less environmentally damaging buffalo production. Or it might help Native Americans rediscover their buffalo culture for both economic and spiritual purposes as well as increase the size of Native American land holdings. These steps would create on the Plains the vast land-use transformation—the expansion and diversification of the overall Plains economy—that my wife and I have elsewhere called the Buffalo Commons.

It is time for the nation to discard its self-deceptive and outmoded antipathy toward regional planning and fully accept the reality that we want, need, and benefit from it, both environmentally and economically. Regional planning should no longer be the public act that dares not speak its name. ■



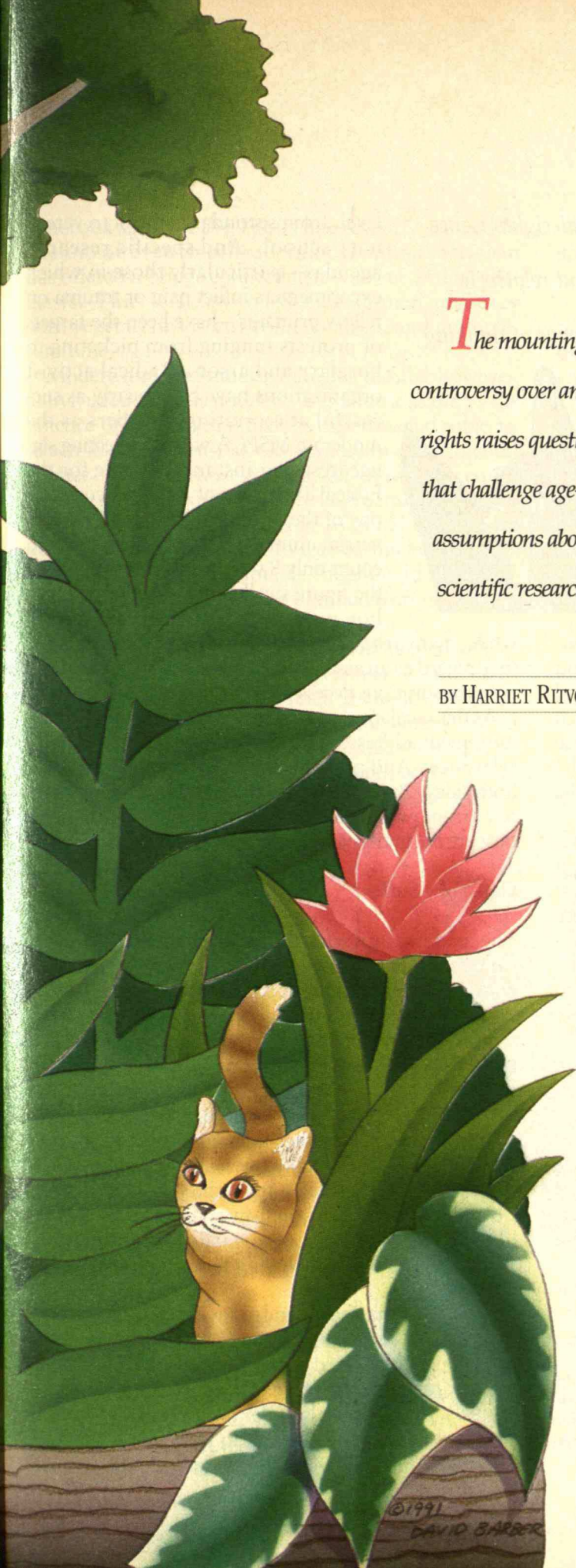
Toward a More Peaceable Kingdom

*The mounting
controversy over animal
rights raises questions
that challenge age-old
assumptions about
scientific research.*

BY HARRIET RITVO

SUPPLICANTS of various sorts tend to congregate at the entrance to my local supermarket. Over the years, I have watched my fellow shoppers firmly ignore candidates for state and local office, solicitors for worthy charities, and advocates of principled positions on important ethical issues. Once, however, I was startled to see a long line of people patiently waiting to sign a petition. The inspiration for this unprecedented show of enthusiasm was the campaign led by the Massachusetts Society for the Prevention of Cruelty to Animals (MSPCA) against the state's pound seizure law, which allowed scientific research institutions to appropriate pets unfortunate enough to end up in shelters. The organizers were trying to collect the number of signatures necessary to place a referendum question on the next statewide ballot. They were successful in their petition drive, and ultimately, despite a countercampaign mounted by the biomedical establishment, they proved able to attract votes as effectively as they had attracted signatures. In 1983 it became illegal to recycle former pets for research in Massachusetts laboratories.

Although my home state has often enjoyed a reputation for political eccentricity, the attitude of its citizens toward pound seizure puts them firmly in the American mainstream. More than 10 other states have similar legislation, and in many of the rest, prohibition of the experimental use of shelter animals is a widely exercised local option. Protest against pound seizure is only one manifestation—and a rather mild



one—of antivivisectionism, or resistance to the use of living animals in scientific experiments. The public is easily moved to shock and pity when the potential experimental subjects are dogs and cats, our most common and best-loved pet species, especially when the individual animals in question have been socialized to regard humans as friends.

Moreover, pound seizure advocates have been unable to argue persuasively that its prohibition would interfere with vital research, and in fact, the relatively few scientists who might have requisitioned pound animals have adjusted to buying what are referred to as “purpose-bred animals”—that is, animals produced in breeding laboratories for lives and deaths as experimental subjects. Thus, despite its broad appeal and the misgivings it aroused in the research community, where any external attempt to influence procedures or decisions can be cause for alarm, the pound seizure controversy faded quickly from public consciousness.

But the sympathy for animal suffering that the controversy exposed did not subside. On the contrary, it has been, if anything, exacerbated by the more radical antivivisection issues that have replaced pound seizure in the headlines. These issues directly engage fundamental oppositions, pitting scientific values against more general moral commitments, human needs and interests against those of other animals, and relatively analytic ways of thinking against more holistic ones.

The growing concern for the suffering of animals in laboratories has had far-reaching practical consequences as well. A sustained media attack on toxicological testing has contributed to the success of enterprises like the Body Shop, a recently transplanted British cosmetics chain that distributes free antivivisection literature as it sells shampoo. Such pressure has also led several major cosmetics manufacturers to stop using animals to test the safety of their products.

The use of live animals in biomedical education has been subjected to court challenges by students at every

Animal-rights issues
often pit relatively
analytic ways of thinking
against more holistic ones.



level, from secondary school to veterinary school. And specific research agendas—particularly those in which experimenters inflict pain or trauma on fellow primates—have been the targets of protests ranging from picketing to burglary and arson. Radical activist organizations have been nearly as successful at recruiting members as the moderate MSPCA was at collecting signatures. For instance, People for the Ethical Treatment of Animals, currently one of the most prominent and controversial animal advocacy groups, could count only 8,000 members in 1985, but the figure swelled to a quarter of a million over the next five years. Mean-

while, many researchers have organized to resist what they regard as an assault on both their work and the scientific institutions necessary to sustain it.

As this escalating activity suggests, the antivivisection movement addresses concerns of special contemporary relevance. And passions have been running high on both sides. But if the heat of battle signals the intensity of current engagement with these issues, it may also obscure the underlying framework of the debate.

Can They Suffer?

The modern antivivisection movement is often dated from the 1975 publication of Peter Singer's *Animal Liberation*. In this landmark combination of philosophy and common sense, Singer developed a powerful “utilitarian” argument for treating the interests of animals as morally significant. That is, he maintained that the pleasure or pain experienced by animals had to be taken into account when calculating the moral value of a given action, and, further, that any human pleasure or pain did not automatically outweigh any animal pleasure or pain. He went on from there to offer instructions to the converted on how to change their lives. (These instructions were rather detailed for a philosophical work, including hints about vegetarian cooking.)

Animal Liberation extended the egalitarian thrust of the protest movements of the 1960s; antivivisectionism, along with related campaigns such as those against factory farming and the exploitation of performing animals, placed animals under the umbrella of concern then newly enlarged, at least in principle, to include humans of all races and both genders. And even if the

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generous spirit of the 1960s has recently seemed in decline or even in eclipse, radical animal activism has offered a bridge connecting it with succeeding zeitgeists. Thus it is easy to associate animal advocacy with vegetarianism, environmentalism, and multiculturalism.

Modern and even modish though it may be, however, antivivisectionism is not new. It is almost as old as the practice of using live animals as experimental subjects, which itself is at least as old as modern experimental science. Even in those early days, vivisection could seem to typify scientific practice in general. For example, Francis Bacon, who died in 1626 of bronchitis, is frequently cited as a martyr to science, but he was actually a martyr to vivisection; he caught cold while collecting snow with which he planned to refrigerate a chicken.

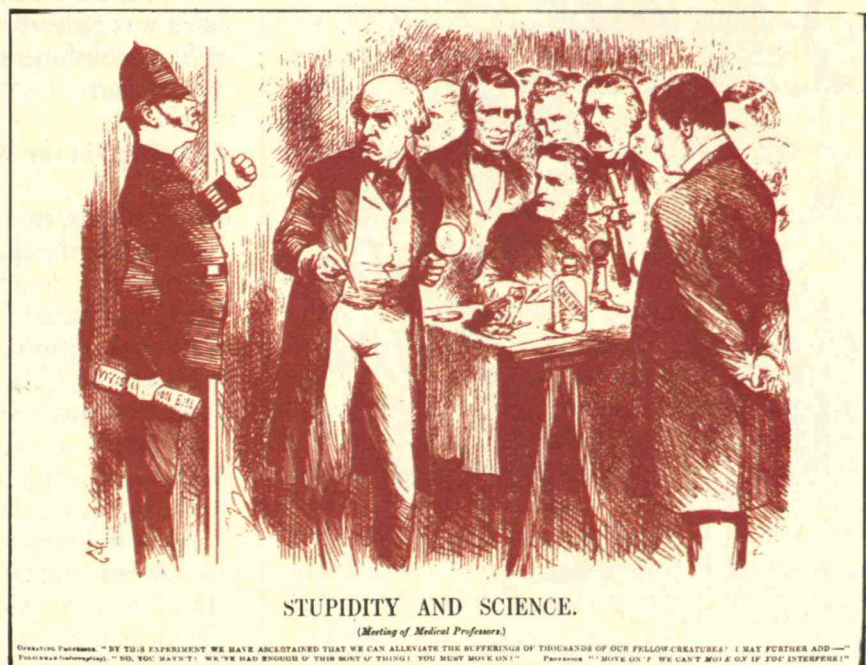
The emergence of lay criticism of animal experimentation is associated with the seventeenth- and eighteenth-century increase in scientific research of all kinds. Interest in discoveries about the natural world extended far beyond the ranks of serious investigators, and during the first part of the eighteenth century there emerged a thriving market for popular science, including books, instruments, specimens, and scientific demonstrations (these entertainments probably filled more or less the same niche as television programs like NOVA). Armed with the self-serving assurance that animals were really unfeeling automata, scientific impresarios cut open howling dogs to display their internal organs and asphyxiated small birds with air pumps. Not surprisingly, some observers were repelled by such spectacles and unpersuaded by the assurances; occasionally one of these nonbelievers managed to administer impromptu euthanasia when the demonstrator's attention was diverted.

Experimentation on live animals also began to attract serious religious and philosophical criticism during this period. In 1789 the English philosopher Jeremy Bentham—a utilitarian and therefore the intellectual ancestor

of Peter Singer—offered the best-known objection. He asserted that “the question is not, Can they reason? nor, Can they talk? but, Can they suffer?”

When Bentham wrote those words, however, vivisection was relatively low on the list of human practices that animals had to fear. Pioneering animal-protection legislation enacted in Great Britain in the 1820s and 1830s focused on the abuse of animals used in commercial pursuits—for example, the overloading of cab horses—and on such lower-class blood sports as bull-baiting and dogfighting. Nevertheless, the issue of antivivisection was raised during the formative period of the (later Royal) Society for the Prevention of Cruelty to Animals, which was founded in 1824 to give teeth to the new laws. The authors of the SPCA's initial prospectus outlined the equivocal position that the mainstream humane movement has often re-endorsed since: they deplored anything that could be characterized as mere cruelty in the name of science, but admitted that under responsible and benevolent direction vivisection might be justifiable.

They were not required to match actions to these words—or even to elaborate upon them—for another generation. During the first half of the nineteenth cen-



This 1876 cartoon from the British humor magazine Punch illustrates scientists' fears that legislation on vivisection would make it impossible for them to perform experiments. The policeman tells the assembled scientists to leave the frog alone and "move on." They reply that as long as he interferes, they can't "move on"—that is, science cannot advance.

tury, vivisection became a common practice in the laboratories of continental Europe, where such disciplines as physiology and immunology were emerging, but British researchers tended to prefer less invasive approaches. Although this national investigative tradition was to lead to one of the most important scientific achievements of the nineteenth century, Darwin's theory of evolution by natural selection, it ultimately became clear that if British scientists were to participate in vanguard biological research, they would have to adopt continental methods. And as vivisection became more common, objections began to arise. Some resistance came from within the scientific and medical com-

munities—usually from old-fashioned practitioners who could foresee that their own standing would be undermined by the new techniques—but most came from members of the public who were simply horrified by what they heard of the sufferings undergone by experimental subjects.

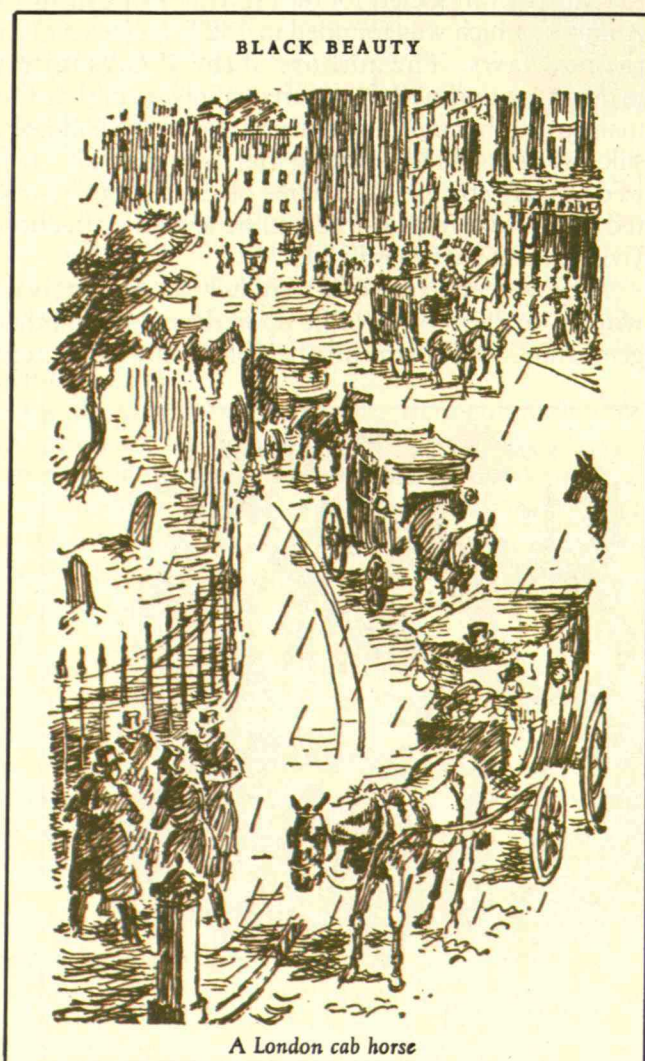
The heated and protracted national debate that ensued had far-reaching consequences. It split the animal protection movement into moderate humanitarians—pragmatists willing to balance human and animal interests—and radical antivivisectionists, who were ideologically opposed to any kind of experimentation on animals. Conversely, it unified the scientific community and inspired what may have been the first organized campaign of scientists to protect their own political interests. Even the elderly Darwin, who had long since abandoned the field sports of his youth and who would not have dreamed of experimenting on live animals himself, enlisted on the side of vivisection, having been persuaded that the future of science itself was at stake.

The controversy culminated in the Cruelty to Animals Act of 1876, the provisions of which were stronger than those of any comparable national legislation that has yet been enacted in the United States. However, instead of prohibiting animal experimentation, the act merely established regulatory procedures, so it was generally perceived as a triumph for the scientific establishment and a defeat for organized antivivisectionism.

The Man in the White Coat

Interestingly, that defeat extended beyond the official sphere into the court of public opinion: gradually, over the next few decades, the antivivisection movement lost its broad-based following and was marooned at the political periphery, where it stayed until its recent renaissance. Even more interestingly, the concerns that underlie antivivisectionism have changed remarkably little in the last 100 years, which may complicate our sense of its relation to other social issues.

For example, the analogy between animals and oppressed human groups that has appealed so strongly to modern animal advocates was less broadly resonant in the late nineteenth century, but it was not absent. Then as now, animal protection organizations of all types had a special appeal for women, perhaps because women were inclined to protect creatures whose helplessness reminded them of their own social position. The advent of gynecology in particular, with its intrusive metal instruments and enforced supine immobility, inspired some nineteenth-century women to identify



*Antivivisectionism was only one manifestation of animal advocacy in nineteenth-century England. For example, the 1877 book *Black Beauty*, an "autobiography" of a horse, movingly described some of the treatment, both kind and cruel, that animals faced outside the lab.*

concretely with animals laid out on the operating table. Members of the working classes also occasionally expressed antivivisectionist feeling, probably reflecting their not unreasonable fear that humble human corpses, however decently buried, would end up under the dissecting knives of anatomists and medical students.

But a much stronger connection between the antivivisection movement of a century ago and that of today emerges if our focus shifts from the image of the passive experimental subject to that of the active researcher. The white-coated laboratory scientist is a familiar symbol of the disciplined and unbiased search for truth and, in the specifically biomedical context, of the search for new knowledge that will alleviate human suffering. From this perspective the researcher seems at once authoritative, upright, and beneficent.

There has long existed, however, a counterinterpretation of this image, in which the immaculate figure appears arrogant and irresponsible, overbearing and cruel. From this perspective the researcher represents an institution devoted not to truth but to self-aggrandizement at the expense of other, often more traditional and less elitist sources of expertise—an institution that follows its own rules, even when these contravene the moral consensus that guides the rest of society. It is this counterinterpretation of the scientist and the institution of science that most powerfully links the antivivisectionists of different eras.

Thus the popular appeal of antivivisectionism tends to rise in direct proportion to public skepticism about the value of scientific research and public resentment of the behavior of scientific researchers. The nineteenth-century peak in antivivisectionist activity reflected widespread shock at the methods of the new biological science, which violated conventional religious attitudes at least as strongly as Darwin's theory of evolution by natural selection did. And public appreciation of such practical benefits of physiological research as insulin and the diphtheria antitoxin explain, at least in part, the turn-of-the-century decline in protests. This shift in opinion initiated a long halcyon period in the relationship between the public and biomedical science. Scientists and laity agreed, for the most part, that the white-coated figure was owed respect and deference, that his (the pronoun is used intentionally) authority over his

*The popular appeal of
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own domain should not be questioned, nor his research methods and goals second-guessed.

It is always difficult to date unbounded occurrences such as shifts in general opinion, but sometime after the Second World War this view of the research enterprise began to seem less compelling, at least outside the scientific community. The most tangible scientific advances apparently led not to healing but to destruction—most spectacularly, of course, the atomic bomb, but also, looking backward, the chemical warfare of the First World War. Moreover, despite generous and sustained government financial support, no scientific fixes have been forthcoming for the terrible

degenerative diseases such as cancer and cardiovascular illness that have killed most Americans since the nineteenth-century triumphs of immunology and public health. And, at best, science has played an ambiguous role in the snowballing environmental crisis. As the various sources of skepticism about the scientific enterprise converged, the time was ripe for the reemergence of antivivisection. Even though both the world and biomedical science had changed significantly, the concerns that inspire animal activism had scarcely altered.

Indeed, in 1896—that is, in the twilight of the earlier antivivisection movement—H. G. Wells published an underappreciated novel, *The Island of Dr. Moreau*, that shows how relevant the issues of 100 years ago still seem. Wells's book chronicles the downfall of an ambitious researcher who, banned from Europe because of his outrageous experimental practices, has retreated to a remote South Sea island to continue his work, which turns out to be the construction of human beings from other animals. The narrator, an English dilettante inadvertently stranded in Dr. Moreau's domain, stresses both the painfulness of the procedures and the presumptuousness of the goal; the island is like a nightmare version of the Garden of Eden.

A modern reader is apt to be struck first by the quaintness of Wells's science—the last time I taught *The Island of Dr. Moreau*, my students quickly pointed out the enormous rejection problems that would be produced by cobbling together organs extracted from animals of different orders—but it soon becomes clear that Wells's underlying critique of experimental science needs very little alteration to bring it up to date. (Even the science can seem timely enough, if allowances are made. For example, if a quest to create new life forms

through the surgical manipulation of animals has become inconceivable, genetic engineering presents a range of analogous issues.)

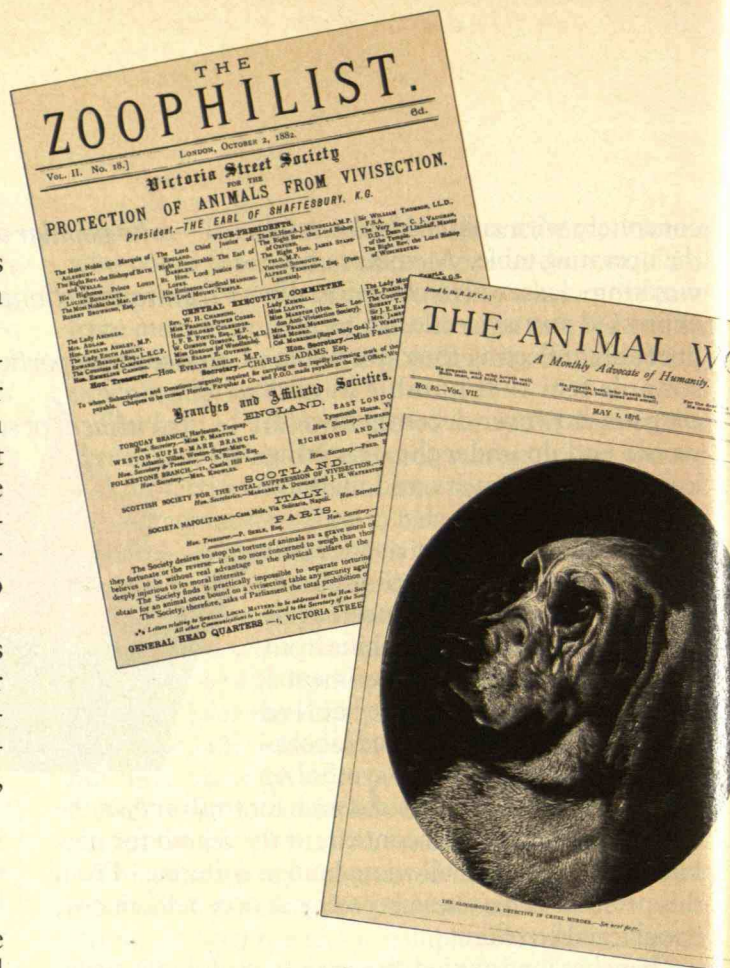
Wells portrays Moreau's obsessive pursuit of knowledge as both inhuman and inhumane. The researcher inflicts pain on his animals only to gratify his own curiosity and ambition; the same motives lead him not only to ignore the strictures of society, but to remove himself from it physically. He contemptuously dismisses the notion that there could be any countervailing ethical considerations powerful enough to persuade him to forgo the acquisition of new knowledge.

It should be emphasized, too, that Wells's censure is independent of Moreau's scientific success. In other words, Moreau's presumption is punished and he ultimately perishes with all his work, even though he actually produces humanoid creatures who can talk, think, and walk on two feet.

The Pursuit of Compromise

Wells's critique of 1896 seems current for much the same reason that Bentham's statement of 1789 is still quoted repeatedly. The underlying objections to vivisection derive from unchanging convictions about the proper relation of humanity to nature, and the practice can come to represent a range of human intrusions into areas that, from a moderate perspective, would be better left alone, and, from a radical one, are despoiled by this contact.

Unfortunately, it is at least difficult, and usually impossible, to reconcile such antivivisectionist convictions with the aggressively inquisitive ideology that underlies commitment to scientific research. This difficulty has been implicitly recognized in the current controversy, most tellingly by the consistent reluctance of the embattled parties to engage each other seriously. There has been a lot of name-calling; the bloody epithets hurled at scientists have been countered by assertions, sometimes angry, but more often blandly condescending, that anyone with antivivisectionist sympathies is either crazy or ignorant. Even when these assertions are not openly made, they are frequently implied. For instance, a recent article in *Issues in Science and Technology* by Jerod Loeb of the American Medical Association and Deborah Runkle of the American Association for the Advancement of Science suggests that ordinary citizens could be induced to abandon any antivivisectionist inclinations they may harbor if only experimenters would take a little time away from their research and devote it to sharing their expert



Nineteenth-century antivivisectionists finally defected from the mainstream humane movement, which did not always support their cause. The Victoria Street Society, publishers of the Zoophilist, argued that it was "practically impossible to separate torturing from non-torturing Vivisection," while members of the Royal Society for the Prevention of Cruelty to Animals, whose organ was the Animal World, often found that they could in fact make such distinctions.

opinions with the public. What is disparaging about this proposal is that the communication is envisioned as a one-way street, as if the public mind were a vacant and inert receptacle, requiring only to be filled with the right ideas.

One reason rapprochement has been so elusive is that in the vivisection debate—as in the debates about abortion and euthanasia—biology, technology, and ethics intertwine, so the kind of give and take that leads to pragmatic compromise is particularly hard to come by. Given the basic premises of each side, the only logically consistent positions turn out to be the impractical and inflammatory extremes: either scientists can do anything they want with animals or they can do nothing at all. As a result, people who seek a middle way just end up bedeviled by questions of degree. Why do some research agendas warrant more animal suffering than others? Why should primates be treated in one way

and cats in another? What is it about rats and rabbits that qualifies them for less-humane treatment? What about frogs and fish?

Nevertheless, there has been some progress. Many parties to the vivisection controversy have recognized that when the logical comes into conflict with the pragmatic, the better part of valor may be to abjure absolute consistency as an unaffordable luxury and settle for reasonableness. Accordingly, they have tried to balance the welfare of individual animals against the social and scientific good that may be done by some research. The mainstream humane movement has generally supported limited animal experimentation under humane conditions and for worthwhile purposes. Thus in 1988, when *Animals*, the magazine of the MSPCA, reported sympathetically on the ethologist Jane Goodall's campaign for

better care of chimpanzees used in AIDS research, one of the main points the author made was that improved conditions would produce more reliable experimental results. A few scientific organizations have recently been founded to pursue goals similar to those of the MSPCA—for example, the Scientists' Center for Alternatives to Animal Testing—and, too slowly, government regulation has also been moving in this direction.

But the real obstacle to constructive change may be the power dynamics that underlie the antivivisection debate. As long as those dynamics persist, efforts from either side are apt to be undermined by the logical appeal and loud voices on their extreme flank. Significantly, the traditional disruptive tactics of antivivisectionism—protests and demonstrations, the marshaling of public outrage—have been deployments of the power of the weak. And however threatening and troublesome the antivivisection movement has occasionally seemed, it has always been weak in relation to biomedical science; that is, it has never had much impact on what actually happens to animals in laboratories.

A lasting resolution of this recurrent conflict would require some genuine sharing of the power of the strong, a restructuring of institutions and procedures to open them to lay scrutiny and influence (real influence, not the token representation that currently characterizes many university animal care and use committees). Yet as has been repeatedly demonstrated in arenas far removed from laboratory science, the strong are not easily moved to such generosity. Antivivisectionists are not the only committed ideologues who have occasionally been pushed to acts of terrorism.

Indeed, the difficulty of accomplishing the necessary reforms would be hard to overestimate, partly because they would inevitably lead to sizable reductions in the number and kind of experimental procedures performed on animals, thus disrupting the research programs of many scientists. Another roadblock is that, like most other groups defined by expertise, scientists are strongly inclined to defend their professional turf and resist external attempts at regulation or governance. Most problematic of all, though, the ideology of science itself will be challenged, forcing experimenters to recognize that they are not necessarily carrying out an independent exercise in the pursuit of truth—that their enterprise, in its intellectual as well as its social and financial dimensions, is circumscribed and defined by the culture of which it is an integral part. This ideology is deeply entrenched and upheld with passionate commitment. But until some minds change, the marching will continue. ■

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Recognizing that it was sometimes necessary to kill animals, moderate organizations sought to do so without cruelty. The London Model Abattoir Society designed a slaughterhouse in which cattle would suffer as little as possible, and the RSPCA advertised pistols that inflicted a minimum of pain.

Trial and Error in Washington

IN 1988, the appointment of John Sununu as White House chief of staff generated great interest and excitement in the engineering community. With bachelor's, master's, and doctoral degrees in mechanical engineering from MIT, Sununu had an unusual background for an American politician. He had spent five years in industry designing heat sinks for transistors and diodes before becoming associate professor and then associate dean of the engineering school at Tufts University. Here was a career path that is the stuff of hortatory speeches at engineering society meetings but rarely found in the real world.

Sununu has now been removed from the White House, and his misadventure provides a sobering lesson. The very intellectual brilliance that gained him praise from friends and grudging respect from foes is being cited as a factor in his ouster. He is faulted for being smart but not "street smart." Although able to marshal data and understand theorems, he showed little patience for human idiosyncrasies and little appreciation for political give and take. His failures, like his successes, seemed linked to his background in engineering, where facts rule supreme. (I find it particularly frustrating that Sununu's replacement, Samuel K. Skinner—widely praised for being a "people person"—is a lawyer. Wherever engineers gather, they complain about how lawyers dominate our political processes.)

Sununu's political interests began with work on his local planning board in Salem, N.H., and from there he was elected to the state legislature. He served as science adviser to the governor of New Hampshire in 1976. After two unsuccessful runs for the State Senate and one failed bid for the U.S. Senate, he was elected governor in 1982. He served three terms and was poised to win an unprecedented fourth when he joined the Bush campaign.

Small wonder that the accomplishments of this brainy technologist—extolled by an MIT professor as one of those students who come along "about once every five years"—should arouse

pride and excitement in a profession disgruntled with its lack of power and prestige. (According to a standard complaint, engineers are always on tap, never on top.)

After a year on the job, Sununu had "silenced many critics who doubted that a Washington outsider could be effective in his position," reported *IEEE Spectrum*, a publication of the Institute of Electrical and Electronics Engineers. The magazine proclaimed in 1990 that this "die-hard engineer in the White House" had become a role model for the profession, one who spoke eloquently about the need for engineers to participate in politics. At the celebration of the twenty-fifth anniversary of the National Academy of Engineering in 1989, for example, he lamented that "we allow policy to be made by those who cannot distinguish the impact" of a technological option.



I fear that in the coming days we will hear the old refrain about engineers' inability to perform in the political arena, a theme frequently sounded at the end of Jimmy Carter's presidency. Columnist Tom Wicker, for example, noted in the *New York Times* that Carter—who was trained in engineering at Georgia Tech and the U.S. Naval Academy, and who spent five years in the Navy's nuclear submarine service—"persisted in the engineer's approach of devising 'comprehensive' programs on this subject or that, but repeatedly failed to mobilize public opinion in their support."

Carter was widely criticized for his technocratic approach to politics, not

only in his failure to communicate well with the public but also in his ineffectual relationship with Congress. Theodore C. Sorensen, the former special counsel to President Kennedy, predicted that history would categorize Carter as the second "engineer president." The first was Herbert Hoover, who ran for president in 1928 as "the great engineer." Hoover was intelligent and worked hard, but with little success. He failed largely because he made no emotional connection with the American people during the crisis of the Great Depression. He was perceived as a stuffed shirt, in marked contrast to his affable successor, Franklin Roosevelt. In Hoover we find the origins of the American engineer-in-politics story—a rather melancholy chronicle, we must admit.

But all is not lost. Engineer-citizens can learn from the shortcomings of Hoover, Carter, Sununu, and others. In

this technological world, engineers inevitably will become leaders, and leaders will have no choice but to understand engineering. Regrettably, engineers in politics have consistently underestimated the power of the capricious human spirit. People, unlike machines, are not generally logical, rational, and predictable. But we will learn from our mistakes: trial and error has always been a key element of the engineering method. ■

SAMUEL C. FLORMAN, a civil engineer, is the author of *Engineering and the Liberal Arts*; *The Existential Pleasures of Engineering*; *Blaming Technology*; and *The Civilized Engineer*.

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Industrial Policy Gaining Converts?

IT took anticommunist stalwart Richard Nixon to go to China; no liberal politician could have pulled it off. Something similar may be about to happen in the debate over whether the government should develop policies to promote the international competitiveness of U.S. industries.

Critics from the left have long argued that the only way to revive the U.S. economy is for government, business, and labor to cooperate in order to unapologetically create industrial winners. Now a growing number of experts from the academic mainstream are publicly worrying that the economy is in serious structural trouble, and that the Bush administration's free-trade philosophy is digging the country deeper into a hole. While not yet explicitly endorsing industrial policy, these mainstreamers are creating the theoretical and rhetorical conditions for reopening the debate.

Two developments are shaking up the conventional wisdom among economists. One is the deadly combination of wage stagnation and wage polarization—that is, the growing gap between the highest and lowest paid among us. Adjusting for inflation, the median U.S. worker now makes 14 percent less than in 1970; consumers are thus naturally reluctant to spend. Meanwhile, growing inequality undermines work incentives and sends a perverse signal to managers: it is cheaper to run a minimum-wage operation than to invest in more productive technologies for factories and offices. Even such prominent proponents of economic orthodoxy as the Brookings Institution's Martin Baily and Gary Burtless now acknowledge that these look like long-run (rather than just cyclical) trends, and that they threaten long-term economic growth.

The second disturbing development is the unsettling shift in the composition of the trade deficit. U.S.-based firms are continuing to lose competitive advantage in high technology. Even in the production of commercial aircraft—one highly sophisticated industry that the United States still dominates—we are losing ground to foreign competition in

such profitable niches as commuter aircraft. Columbia University professor Richard Clarida and his New York Federal Reserve Bank colleague, Susan Hickock, presented evidence of this trend at a recent conference of leading economists at Columbia. Between 1978 and 1990, they reported, high-technology products gained almost 20 percentage points as a share of real U.S. imports, but only about 4 percentage points as a share of real U.S. exports.

This worsening composition of U.S. trade is self-perpetuating. High-tech production, at least initially, entails a lot of learning by doing, and this learning does not easily spill across firms or international borders. Therefore, faster high-tech output growth abroad—even by subsidiaries or partners of U.S. companies—produces more rapid learning outside the United States than in it. So initial gains in a company's market

spend less time cajoling the Japanese to be more like us and more time considering whether we might do better by being more like them." Blinder was thinking mainly of Japanese labor-management practices and of management's comparative independence from stockholders, but he refers as well to the successes of long-term planning by Japanese government and business.

The good news, then, is that a growing number of U.S. economists are confronting the inability of orthodox theory to explain what is happening to the country. As they do so, they are rediscovering the importance of learning by doing, positive feedback phenomena, and increasing returns to scale (that is, the notion that the "first mover" into a sector or product line will continue to be able to produce larger volume at lower average production cost, thereby maintaining an advantage over new competi-



share lead to further increases, especially in industries with large economies of scale or brand-name recognition—a positive feedback phenomenon that can wreak havoc with conventional economic theory.

Evidence of a growing high-tech trade gap powerfully challenges the arguments that undergird the usual notions of free trade. Still, fear of government ineptness, plus the elegance of textbook free-trade theory, continue to inhibit most mainstream economists from embracing industrial policy. But, as Princeton macroeconomist Alan Blinder wrote recently in *The American Prospect*: "Perhaps Americans should

tors). Perhaps as these inquiries proceed we will hear less about the magic of the free market, less about whether to pursue an industrial policy, and more about what kind of industrial policy we want and for which groups among us it is likely to do the most (and the least) good.

As for the presidential candidates: Will the next Richard Nixon please stand up? ■

BENNETT HARRISON is coauthor of The Deindustrialization of America and The Great U-Turn (Basic Books). He is professor of political economy in the School of Urban and Public Affairs at Carnegie-Mellon University.

Why We Need A Smaller U.S. Population And How We Can Achieve It

We need a smaller population in order to halt the destruction of our environment, and to create an economy that will be **sustainable** over the very long term.

We are trying to address our steadily worsening environmental problems without coming to grips with their root cause – overpopulation.

If present immigration and fertility rates continue, our population, now over 254 million, will pass 400 million by the year 2050 -- and still be growing rapidly!

All efforts to save our environment will ultimately be futile unless we not only halt U.S. population growth, but reverse it, so that our population can eventually be stabilized at a **sustainable** level – far lower than it is today.

The Optimum U.S. Population Size

The central issue is surely this: **At what size should we seek to stabilize U.S. population?** Unless we know in what direction we should be headed, how can we possibly devise sensible policies to get us there?

The size at which our population is eventually stabilized is supremely important because of the effect of sheer numbers on such vitally important national goals as a healthy environment, and a sustainable economy.

We believe these goals can best be achieved with a U.S. population in the range of 125 to 150 million, or about its size in the 1940s. This optimum size could be reached in about three to four generations if we do two things now that are well within our grasp.

How To Get There

1. **Reduce annual immigration to about 200,000** so that it is in rough balance with emigration (out-migration). Then, immigration will no longer contribute significantly to our population growth, as it does now.

2. **Lower our fertility rate** (the average number of children per woman) from the present 2.1 to around 1.5 and maintain it at that level for several decades. We believe that non-coercive financial incentives will be necessary in order to reach that goal.

If almost all women had no more than two children, our fertility rate would drop to around 1.5, because many women remain childless by choice, or choose to have not more than one child. **We promote the ideal of the two-child maximum family as the social norm, because that is the key to lowering our fertility.**

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- Give a cash bonus for voluntary sterilization to both men and women under age 35, who have already had at least one child.

Two Vastly Different Paths Lie Before Us

With the reductions in immigration and fertility we advocate, our nation could start **now** on the path toward a sustainable population of 125 to 150 million.

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If you agree that we need to work toward a smaller U.S. population, we need your support. **NPG is the only organization that calls for a smaller U.S. and world population, and for specific, realistic measures to achieve those goals.**

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Reviews

BOOKS

OF MICE AND MACHINES

The Cybernetics Group
by Steven J. Heims
MIT Press, \$25

BY WILL WARNER

WORLD War II sped the creation of highly useful theory in machine control and communication engineering. Immediately after the war, a small group of scientists combined elements of the two fields and called the synthesis "cybernetics." Mathematician Norbert Wiener, who contributed as much as anyone to the new science, subtitled it "control and communication in the animal and the machine."

The premise of cybernetics is that the same theoretical concepts that explain a machine tool can explain a mouse. From communication engineering comes a formalized conception of "information," with the binary digit, or "bit," as its fundamental unit. These ideas aid in designing the computer that controls the machine tool and understanding the brain that controls the mouse. Control theory contributes the notion of "feedback," which is essential for finding just the right touch with motors or muscles. With information from a feedback channel, a controller eliminates the difference between what exists and what is desired by tailoring its response appropriately.

The engineers and mathematicians who created cybernetics were excited by it and thought they saw applications in other disciplines. So did practitioners in those fields. Sociologists, psychologists, and political scientists had recognized something like cybernetic feedback helping to maintain equilibrium in families and society. Biologists had identified many examples of homeostasis in living



organisms, and anthropologists spoke of mechanisms that restore balance in the world's cultures.

Interest in fusing cybernetics with these disciplines—mostly "human sciences"—was strong enough to produce a series of 10 conferences, beginning in 1946 with "The Feedback Mechanisms and Circular Causal Systems in Biology and Social Sciences." Sponsored by the Josiah Macy Jr. Foundation, among whose concerns is mental health, the conferences brought together prominent cyberneticians like Norbert Wiener and John von Neumann with an elite group of psychiatrists, psychologists, anthropologists, and social scientists, among them Margaret Mead, Gregory Bateson, and Paul Lazarsfeld.

How did it go? Did cybernetics—which is essentially applied mathematics—take hold in the human sciences? How well did the two groups get along? And what did the conference series reveal about their different world views and methods of inquiry?

Steven J. Heims, a physicist turned science historian, answers such questions in *The Cybernetics Group*. Here he claims to "describe a moment when a set of ideas [cybernetics] impinged on the human sciences and began to transform some traditional fields of inquiry." His

study convinced him that the conference series "played a significant historical role in the development of the human and natural sciences in the U.S." Heims also became convinced of the value of elite groups interacting and using their collective clout to guide research in new directions.

High Hopes Unfulfilled

On this last point, the evidence is mixed. Heims reports that social scientist Gregory Bateson "regarded the cybernetic conferences as an intellectual event of the first magnitude" and "generously acknowledged their enormous influence on his own work." For sociologist Alex Bavelas, the conferences "had a profound effect . . . in spite of what might have appeared to be no effective communication between the engineers present and the social scientists." Yet mathematician Leonard Savage considered the meetings "primarily bull sessions with a very elite group" and "could never take seriously the ostensible purpose of coming there to blend [the] disciplines or to grapple with each other's problems."

Nevertheless, the book makes a good case that the imprimatur of eminent human scientists opened their fields to research along lines suggested by cybernetics. Kurt Lewin, a psychologist, perceived that "planned social action and the ability to steer that action involves a goal, general fact finding and monitoring, a choice of path, [and] modification of plans and actions in response to information." In short, he wrote, social action is a self-regulating process that uses feedback. Accordingly, Lewin sought laws of human behavior that could be tested by experiment. He developed an elaborate theory of behavior, a kind of psychological topology, complete with special symbols, rules for their manipulation, and rules of inference. Just as experimental and mathematical procedures had integrated the physical sciences, Lewin wrote, so could they integrate the social sciences.

Lewin's ideas caused some excitement and inspired more research. Yet Heims reports that neither his theory nor the use of topology and vectors in social psychology has survived.

Such was the fate of most, if not all, of the attempts to introduce cybernetics into the human sciences. "Although some individuals created a personal synthesis using ideas from cybernetics," writes Heims, no "comprehensive unity in science could be derived from it." Cybernetic terms such as "feedback," "bits," and "information transfer" entered those fields, and the human scientists adopted some of the reductionist, analytical methods of the hard sciences. But in attempting to quantify their subjects—a prerequisite for applying cybernetic theory—they oversimplified to the point of vacuousness.

Perhaps the effort failed because the human scientists could not make it through a full cycle of the scientific method—observation, hypothesis, and experiment. These researchers had mastered the first part; through polling and surveys and careful watching, they gathered huge amounts of data. But in a hard science like cybernetics, that middle part—the hypothesis—is a mathematical expression, a "function." Ideally, the function describes a smooth and continuous curve that passes through all the data points discovered by observation. The countless points in between constitute predictions: if you run x experiments or make y observations, you will find these other points on the curve.

Such curves work reasonably well in sciences like physics (though even there they are approximate and simplified). When the subject is human behavior, however, the curves are just too crude to be useful.

By the end of the book, we are left with a sense that the high hopes of the conference sponsors went unfulfilled. Yet this conclusion does not mean that the Macy Conferences were unimportant or that their story should not be told. As the author points out, the blind alleys of science are part of its history.

The Way of All Matter

Even if the conferees' mission proved quixotic, the meetings were significant in another way: they brought about a fascinating collision of hard and soft sciences—and of mechanists and humanists—which Heims documents compellingly. The diverse scholars assembled to cooperate and learn from each other, but their styles clashed, producing an undercurrent of tension, superiority, and resentment. Heims notes that the traditional pecking order emerged, with the hard scientists on top; the soft scientists clearly envied their prestige as much as their abstract, mathematical formulations and their logical deductions.

The participants were divided over the potential harm of introducing a derivative of control and automata theory into the human sciences. Would cybernetics be used to understand and ameliorate the human condition? Or would it lead to dehumanization, intrusion, and manipulation by Big Brother social scientists? Wiener warned of the dangers in *The Human Use of Human Beings*, but the debate was primarily among the human scientists, between those who were looking for ways to "improve" society and those opposed to meddling.

Perhaps the biggest bone of contention was the very concept of people as machines. Although many participants were ardent mechanists and comfortable with such a picture, Margaret Mead, social psychologist Erik Erikson, and others could always find things about brains, behavior, or society that did not fit cybernetic models. The cyberneticians claimed, for example, that a computer could represent and reason about anything that can be described completely and unambiguously in words. Yet the human scientists wondered how much of what people know can be expressed completely and unambiguously.

Heims himself fears that mechanistic metaphors "may engender distasteful hypotheses about humans" that ignore

notions of love and understanding. He objects to descriptions of life that emphasize mechanistic concepts like energy and entropy because they discount the "special value we place on fellow human beings." Such objections bring to mind the earlier denial of our nonhuman ancestry with which Darwin had to contend, and it's hard to escape the suspicion that vanity is behind both of these prejudices.

People who share Heims's view have yet to answer a fundamental question: if we are not machines, what are we? Social scientists' inability to fit a curve to human behavior may be a sign that we are something else. On the other hand, maybe all it means is that a machine can't understand itself. Biomedical engineering, which is cybernetics in the flesh, has given us artificial limbs and organs and restored lost senses. These achievements suggest that human beings are machines, at least in part. Even if there is some question about the nature of our brains, our bodies are clearly servomechanisms outfitted with pumps, dissolving tanks, filters, lenses, and other mechanical stuff. Much like—no, exactly like—automobiles, our bodies convert chemical energy into heat and movement and give off exhaust.

Whether we are machines or merely live inside machines, we have to contend with this fact: each of us is the site of diminished entropy. That puts us in deep trouble with the second law of thermodynamics, which says that decay is the only natural process, and that decay can only be slowed, not stopped. Feeling "special," to use Heims's word, is not enough to win an exemption from this law. Alas, the way of all flesh is the way of all matter. The universal downward tug, given time, will reduce to dust the machine tool, the mouse, and the man. This is the source of the tragic human condition you've heard so much about. ■

WILL WARNER, a writer and computer engineer, struggles against decay in *Ann Arbor, Mich.*

BOOKS

A BLUE-GREEN
DIAGNOSIS

*Healing the Planet: Strategies for
Resolving the Environmental Crisis*
by Paul R. Ehrlich and Anne H. Ehrlich
Addison-Wesley, \$22.95

BY KATHLEEN COURRIER

TWENTY-THREE years after Paul Ehrlich gave the then-small U.S. environmental movement its marching orders in *The Population Bomb*, he and his wife and colleague Anne Ehrlich are back with a new game plan for saving earth's most inventive and rapacious species from itself. More ambitious than most of the popular books Mr. Ehrlich wrote between 1968 and 1990, *Healing the Planet* is billed as "a starting framework for considering what needs to be done and which personal actions [might help] restore the integrity of our planet's environmental systems and thus secure the human future."

The Ehrlichs start down the green brick road to a better world by separating environmental headaches from full-fledged threats to survival. Interestingly, the two ecological showstoppers that most concern them were scarcely issues when they began their work in population biology close to a quarter century ago: the rapid loss of biological diversity and human-caused global climate change.

Some of the bleakest predictions in *The Population Bomb* proved wrong because in 1968 Paul Ehrlich had greatly underestimated the power of technology to overcome constraints on resources, and the power of markets to deliver affordable substitutes for scarce commodities. In a now-famous 1980 wager with economist Julian Simon, Ehrlich bet \$1,000 that the prices of copper and



four other metals would rise over the ensuing decade. They didn't, and Ehrlich has learned not to be deceived by prices—a poor measure of the full social or ecological cost of resource losses—as well as to take economists seriously, confining categorical claims about irreplaceability mainly to the living world. Biological impoverishment tops the Ehrlichs' agenda principally because extinctions are forever and humanity is fast destroying a "resource for which there is absolutely no substitute."

Of course, earth's made-to-order atmosphere is all but irreplaceable too. With climatologist Stephen Schneider as their guide, the authors amass compelling evidence that the potential risks of global warming and ozone depletion to agriculture, species, coastal zones, and ecosystems are so unacceptable that we should do everything we can to slow both processes as a hedge, even if the costs are high. They point out that many of the energy-conservation and similar measures required make sense for other economic and environmental reasons.

Two other items on the Ehrlichs' "short list" were also fleshed out with the help of a handful of like-minded experts. The case for energy conservation draws heavily on the planetary energy scenario developed at Berkeley

by John Holdren: with near-heroic governmental effort, world population would level off at 10 billion by the year 2100 and, thanks mostly to improved efficiency, per capita energy use would stabilize at 3 kilowatts per person annually (instead of 7.5 in rich countries today and 1 in poor) without seriously crimping modern life-styles. The argument for husbanding the planet's agricultural resources—to stanch topsoil erosion, chemical runoff, salinization, and the loss of prime farmland to urban sprawl—builds on Worldwatch Institute's annual *State of the World* reports.

This division of intellectual labor is efficient, and the Ehrlichs scrupulously give credit where it is due. But the reshaped material contains few surprises. Except for a detailed discussion of renewable energy options, the more than 200 pages devoted to environmental threats hold little new for those who read a good daily newspaper.

A New Eco-nomics

The risks the Ehrlichs took in repeating themselves and others were calculated. Although the avalanche of environmental books released for Earth Day in 1990 left few niches empty, in just two years the ozone hole has grown, the hottest summer on record has fueled more speculation about the greenhouse effect, and new theories of global warming (one involving the bacterial release of methane from tundra) have emerged—certainly enough news to justify the well-informed update that *Healing the Planet* provides. The Ehrlichs probably also figured that would-be environmentalists might appreciate one-stop shopping. But the best reason for doubling back over well-covered ground is, as the authors note, to lay the foundation for their solutions.

In making their recommendations, the Ehrlichs wax skeptical about both politically simpleminded "how to live green" books (which, they say, mainly address the symptoms of overconsumption and maldistribution) and such

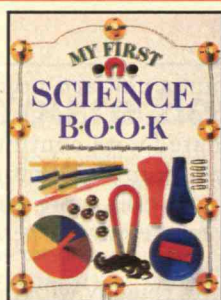
Creative science books for curious kids

catchall slogans as "sustainable development" (which too often refers to sweeping reforms in poor countries, as though rich ones need not change). Green consumerism has its place, say the authors, and sustainable development broadly defined and decoupled from a drive toward economic growth is civilization's only insurance policy.

But a new mind-set is needed as well. Although the Ehrlichs hint that the human race comes by its aversion to long-range planning genetically, they are optimistic that people will do right by the planet once the rare few with vision convince the rest that we are running a gigantic experiment with our own lives and the human future. The authors cite Eastern Europe's recent rejection of communism as evidence that societies can change course quickly once they recognize their mistakes, and they sketch a new path for the environmentally errant United States.

To loosen "the automobile's stranglehold on [U.S.] society," the Ehrlichs propose gas taxes, "feebates" (point-of-sale taxes on fuel-guzzling vehicles and rebates on gas sippers), a return to mass transport, a moratorium on highway construction, and better land-use planning. To put the somewhat chimerical "peace dividend" to its best use, they recommend channeling \$100 billion into refurbishing our transportation system and creaky infrastructure and shuffling some GIs into a green Peace Corps charged with environmental restoration. They would also have us redefine national security to take environmental threats into account and vote a "brain-dead leadership" out of office. The Ehrlichs back these recommendations with upbeat pump-priming suggestions for what scientists, teachers, and other professionals can do to save the earth, and they urge all Americans to tithe their time to the cause.

Unfortunately, this combination of brainstorming and good-natured exhortation doesn't add up to a coherent environmental agenda or the promised framework for action. The authors admit as much toward the book's end



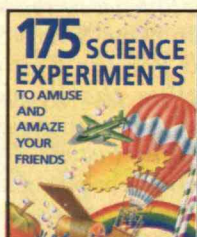
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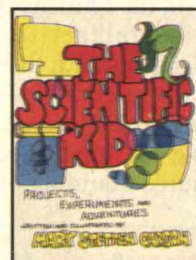
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when they allow, in a sort of bring-in-the-Marines way, that "perhaps even more than ecologists [like themselves], economists hold the key to the future."

Such appeals to the dismal science are not new. During the Reagan years, economic arguments became the environmentalists' most effective tools in Washington. In fact, as Bret Wallach points out in *At Odds with Progress*, such arguments have been used successfully for much of this century to buttress and even disguise aesthetic, ethical, and other politically weightless rationales for conservation.

Even so, the Ehrlichs aren't ready to entrust the planet to mainstream economists. Instead, they want to rescue environmental economics from academia's backwaters and to ground the whole discipline of economics in a deeper understanding of the physical

world. They want a new *eco*-nomics that pays more heed to the "rising externalities" associated with continued growth, recognizes the market's intrinsic limitations, and provides more earth-friendly indicators of economic performance than the GNP.

This call squares roughly with those of longtime dissidents such as Hazel Henderson (*The Politics of the Solar Age*) and Herman Daly (*Steady State Economics* and *For the Common Good: Redirecting the Economy Toward Community, the Environment, and a Sustainable Future*). And economists will no doubt play a larger role in crafting solutions as the scientific consensus on such major environmental issues as species extinction rates, ozone depletion, and even climate change tightens, making it harder to deny or table problems pending further research. But the fact remains that the Ehrlichs themselves have not given citizens or policymakers much more than a well-wrought summary of what ails the planet and a blue-green critique of neo-classical economics. Some of their recommendations are really wishes on a star (like putting checks on "the inequitable distribution of wealth and resources, racism, sexism, religious prejudice and xenophobia"). And too many (like the need for developing countries to make a "concerted effort . . . toward making integrated pest management or chemical-free farming succeed") simply haven't been thought through.

Maybe the people who define environmental problems shouldn't be expected to know how to solve them. And maybe the Ehrlichs' attempt to cross that great divide reflects their frustration with policymakers and conventional economic advisers who won't. But *Healing the Planet* should be called *Diagnosing the Planet*, and the Ehrlichs must try again if they want to bridge environmental science and environmental policy. ■

KATHLEEN COURRIER directs the publishing program at the World Resources Institute in Washington, D.C.

ing nuclear weapons verification, energy efficiency, and environmental protection, and we have fashioned a three-tiered approach to environmental problem solving that we have found useful. First we show why new environmental institutions are needed and empower people with the tools for effectively participating in decision making. Then, since Russians tend to be dreamers who are long on theory but short on practice, we set up small-scale demonstration projects. These not only illustrate the need for institutions or processes but help break them in.

The essential third step is to develop infrastructure. Because there is no infrastructure for responding to price signals, for example, raising prices now will not help achieve environmental goals; it will merely cause hardship for consumers and a drop in production.

NRDC believes it is in no one's interest for the Russians to repeat the mistakes of conventional economic development. The present Soviet reality is full of "insurmountable opportunities" to affect environmental problems that are truly global in scale, and we urge those with the needed expertise and capital to seize these opportunities rather than to wait and see what happens.

ROBERT K. WATSON
Co-Director
NRDC Soviet Energy Project
Los Angeles, Calif.

On August 10, 1985, the reactor on a nuclear-powered submarine exploded in Chazma Bay some 35 miles from Vladivostok in the Pacific. Ten men were instantly killed, and Soviet news accounts claim that radiation meters went off the scale at fatally high levels of 600 roentgens an hour. Many such disasters in the ex-Soviet Union have, like this one, been kept secret. Some 16 to 20 percent of the country's territory is an environmental catastrophe, and 40 percent is polluted—virtually all the inhabited areas, according to former environmental minister Nikolai Vorontsov. The main unpolluted region is Siberia.

While Soviets of all persuasions are

TechnologyReview

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fascinated by the promise of a free market, few seem to understand that it will not fix the mistakes of the past. Private companies may do the work, but public funds will be needed to pay for the cleanup.

Moreover, the incipient market is creating new environmental problems. For example, local officials are so eager to earn hard currency that they are promoting deals for natural resource extraction and paying little attention to environmental impacts. In the Far East, the governor of the Primorskii Kray wants foreign companies to start large-scale logging of local forests. In the Central Siberian region, people are concerned about the effects of Western oil interests. They also worry that foreign companies will dump wastes there and set up plants whose safety procedures are less stringent than they would have been elsewhere.

It is at least reassuring that Soviet ecologists are aware of these problems and know that the market is not a panacea. There is a recognized role for government action, including legislation, regulations, tax incentives, and fines. Such action could help preserve the environment, provide for cleanup, and force producers to internalize more of the social and environmental costs of production.

There are also other reasons for hope. One is that as military spending declines, resources will be freed to clean up the environment and create more energy-efficient and environmentally sound production processes. Another is that the republics will maintain their role in providing ecologically helpful public services. For example, the widespread public transportation system should be improved rather than abandoned in favor of mass auto production. Finally, Western countries could provide needed technical help and make ecologically sound investments. A lesson of Chernobyl should be that the West has as much at stake in the Soviet environment as the Soviets.

JOSHUA HANDLER
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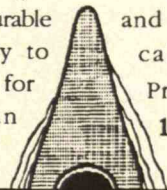
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Notes



Where's the Beef?

The original Big Bird, the diatryma—one of the biggest birds ever to inhabit the earth—was no muppet, nor was it like any other bird imaginable. It stood almost seven feet tall and had a head the size of a polar bear's. And according to a study by scientists at Johns Hopkins, it didn't eat plants and grains, like most of today's largest birds, but rather tiny horses, lemurs, and other mammals that populated the planet some 55 million years ago.

Some researchers have suggested that the diatryma was a plant eater because its skull is shaped like those of a few leaf-eating birds alive today. But the Johns Hopkins paleobiologists, who have just completed a study on the biomechanics of the bird's jaw based on fossils recently found in Wyoming, believe that the bird was carnivorous and may have been a bone crusher. They also point out that the diatryma's skull is at least five times the size of the largest modern leaf-eating bird—large enough, in fact, to eat almost any animal of its time.

Cockpit Confusion

On-board computers were meant to make flying easier, but they can often confuse pilots of modern aircraft, according to researchers at

Ohio State University. So-called "glass cockpit" planes, in which computer screens have replaced old-fashioned dials and switches, can be programmed to automatically climb, cruise, descend, land, and brake to a stop. But pilots say the systems are overwhelming.

Two-thirds of the 135 pilots questioned have been surprised at how the system functions in some situations. Some find it difficult to select the most appropriate action from the multitude of options available to accomplish a given task. Some have trouble taking over for other pilots who may have programmed the system slightly differently. And many complain that the system is user-unfriendly, flashing "Invalid Entry" instead of explaining why a given input is unacceptable.

The researchers conclude that because human error remains the main culprit in airplane accidents, it will be crucial to redesign the cockpit layout and improve the computer-pilot interface.

Dream Dinners

Most people who get the midnight munchies are at least partially awake when they get up to raid the refrigerator. Not so

with a group of patients under study at the Minnesota Regional Sleep Disorders Center, who habitually eat huge quantities of food—as well as strange items, such as buttered cigarettes—while sleepwalking. And although most of them eat every night, often more than once, they have little or no memory of their feasts and deduce their behavior only after discovering the remains of food in bed or on their nightclothes.

Researchers contend that polysomnograms of these patients—which reveal an unusual mix of sleeping and waking brain waves—provide new evidence that some people can be both asleep and awake at the same time. They also believe that like narcolepsy, once thought to be a bizarre and incurable psychiatric disorder that often causes a person to dream while awake, sleep-eating is treatable with medication or hypnosis.

Swapping Scientists

Baseball cards have certainly had their day. But to fans of science and technology, the premiere edition of "Scientist Trading Cards" from the Oregon Graduate Institute of Science & Technology (OGI) in Beaverton may become the hot collectible.

Intended to publicize OGI scientists and their work, the cards appear to have caught on. The school receives about five requests for cards per day from kids, parents, teachers, and from sources as diverse as Massachusetts General Hospital and the Smithsonian Institution. In fact, according to an OGI spokesperson, the Smithsonian is considering making the cards part of a museum exhibit. If interest continues to grow, OGI says it may consider offering cards of scientists from other institutions around the country or the world.



The first set of two-color, 3-1/2 by 2-1/2-inch cards describes the educational background, research interests, grants, publications, and hobbies of five OGI scientists. Subsequent sets of three or four new cards will be sent every month—without bubble gum—to those on the OGI mailing list.

Muscular Proteins

Once considered a weak candidate for a leading role in genetic therapy, muscle cells may have a surprising talent for acting as molecular ambulances to deliver specific genes, and the beneficial proteins they produce, into the body on a long-term basis. Researchers at Stanford University and the University of Michigan inserted the gene for human growth hormone, which is normally expressed in the brain's pituitary gland, into immature muscle cells from mice. When the altered cells were injected into muscle tissue in mice, they were not only accepted as normal muscle cells but were able to secrete therapeutic levels of the growth hormone, which was picked up by the bloodstream and circulated throughout the body.

Cells from skin, the heart, the liver, connective tissue, and blood vessels tend to get eliminated from the body. But muscle cells have the ability to fuse tightly with normal muscle fibers.

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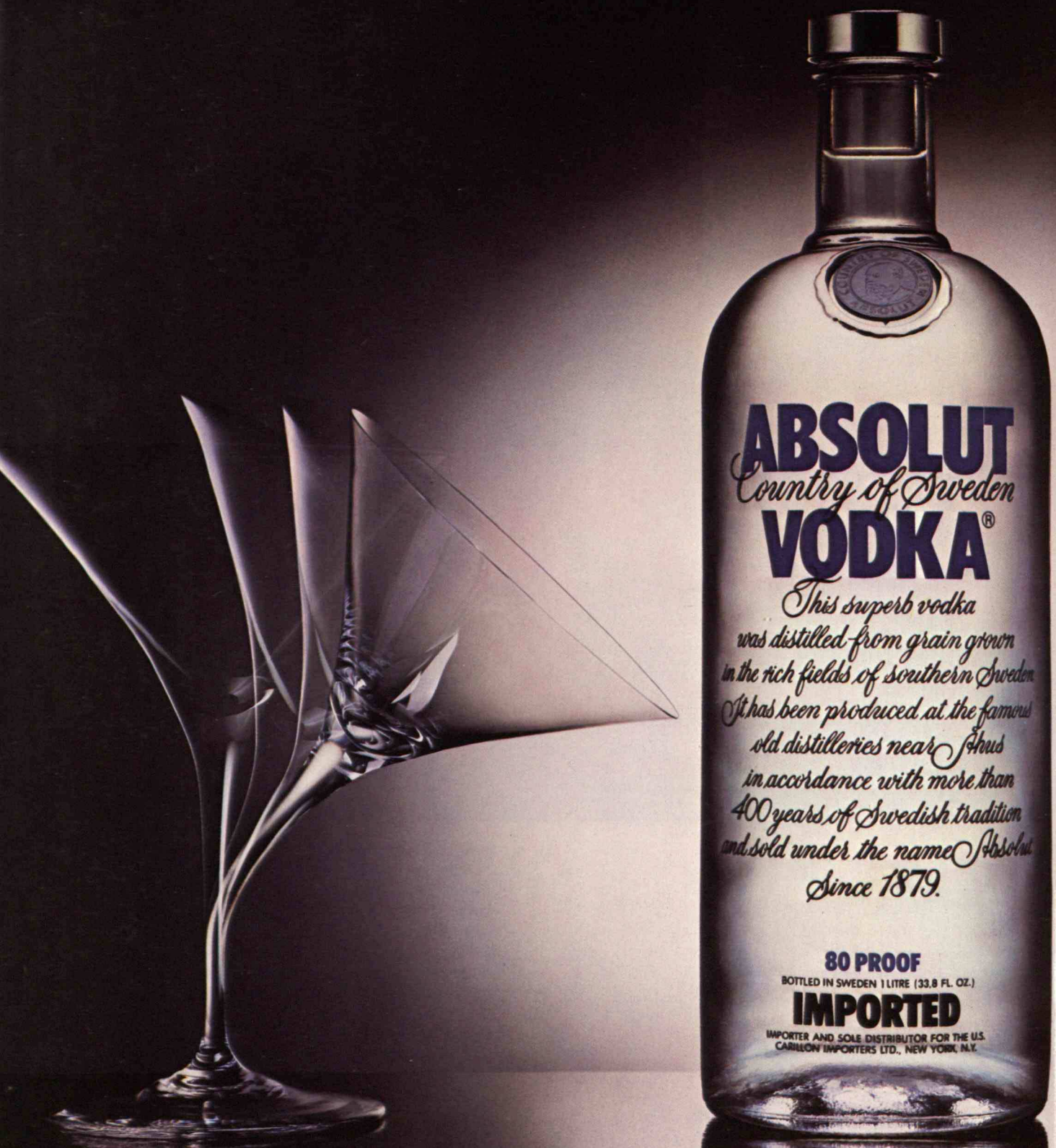
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